

**FOR THE BIRDS: RESEARCHING THEORY AND PRACTICE IN
ENVIRONMENTAL CONSERVATION POLICY PROCESSES**

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Presented to
The Academic Faculty

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**FOR THE BIRDS: RESEARCHING THEORY AND PRACTICE IN
ENVIRONMENTAL CONSERVATION POLICY PROCESSES**

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS	iii
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF NOMENCLATURE	ix
SUMMARY	x
CHAPTER 1: INTRODUCTION	1
CHAPTER 2: The Common Thread.....	4
2.1. Theoretical Framing	4
2.2. Stitching it all Together.....	6
2.3. Dissertation Roadmap	10
CHAPTER 3: Let Sleeping Bats Lie: Analyzing institutional adaptation to environmental regulatory change through Adaptive Management theory.....	11
3.1. Introduction	11
3.2. Adaptive Management Models	15
3.3. A Mixed Methods Analysis of Adaptation to Environmental Shocks	18
3.4. Results	25
3.4.1 Adaptive Management Process at GDOT	25
3.4.2. Adaptive Management and Performance	32
3.4.3. Generating Learning through Adaptive Management.....	37
3.5. Discussion	38
3.6. Conclusions	42

Special Acknowledgements	46
CHAPTER 4: It's Turtles All the Way Down: The pros and cons of stakeholder enthusiasm in collaborative sea turtle management.....	47
4.1. Introduction	47
4.2. Stakeholder Engagement.....	48
4.2.1. Benefits of Collaboration	50
4.2.2. Potential Drawbacks.....	51
4.2.3. Engagement in Organizations	52
4.2.4. Managerial Motivations	54
4.2.5. Target Fixation	55
4.3. Research Context.....	56
4.3.1. The Georgia Sea Turtle Cooperative.....	57
4.4. Research Questions & Hypotheses	59
4.5. Materials & Methods.....	61
4.6. Results	62
4.6.1. Management Capacity.....	62
4.6.2. Motivations for Action	65
4.6.3. Target Fixation	71
4.7. Discussion	76
4.8. Conclusions	80
Special Acknowledgements	82
CHAPTER 5: As the Crow Flies: Moving beyond a proximity-based understanding of policy diffusion	83
5.1. Introduction	83
5.2. Literature Review	85
5.2.1. Policy Diffusion	85
5.2.2 Internal Determinants.....	85
5.2.3 External Determinants.....	86
5.2.4. Mechanisms of Diffusion.....	87
5.3. Policy Context.....	91
5.3.1. Ecotourism	92

5.3.2. Birdwatching Trails.....	97
5.4. Materials & Methods.....	101
5.4.1. Data	101
5.4.2. Methods.....	105
5.5. Results	106
5.6. Discussion	107
5.7. Conclusions	109
CONCLUSION.....	110
APPENDICES	112
Appendix A	112
Appendix B	112
WORKS CITED	115

LIST OF TABLES

Table 1: Distribution of Projects	22
Table 2: Variables	24
Table 3: Regression Results	34
Table 4: Sea Turtle Species in Georgia.....	57
Table 5: Respondent Categories.....	61
Table 6: Average Percentage of Respondents Prioritizing Different Subjects	68
Table 7: Descriptive Statistics.....	104
Table 8: Fixed Effects Regression Results.....	106
Table 9: Fixed Effects Regression Results (Extended).....	112
Table 10: Descriptive Statistics of Alternative Mechanisms	113
Table 11: Alternative Mechanisms Robustness Checks	114

LIST OF FIGURES

Figure 1: Social-Ecological System (SES) Model	5
Figure 2: Adaptive Management Model	17
Figure 3: Timeline.....	25
Figure 4: Adaptive Management at GDOT.....	28
Figure 5: Multi-Tiered Collaboration	40
Figure 6: Improved Adaptive Management Model.....	41
Figure 7: Date of State Implementation	99

LIST OF NOMENCLATURE

Adaptive Management	AM
Akaike's Information Criterion	AIK
American Birding Association	ABA
Categorical Exclusion	CE
Coastal Resources Division	CRD
Endangered Species Act	ESA
Environmental Assessment	EA
Environmental Impact Statement	EIS
Georgia Department of Natural Resources	GDNR
Georgia Department of Transportation	GDOT
National Environmental Policy Act	NEPA
National Marine Fisheries Service	NMFS
New Public Management	NPM
New Public Service	NPS
Non-governmental Organizations	NGO
Ordinary Least Squares	OLS
Social-Ecological System	SES
State Department of Transportation	SDOT
Texas Parks and Wildlife Department	TPWD
The International Ecotourism Society	TIES
US Department of Agriculture	USDA
US Fish and Wildlife Service	USFWS
Variance Inflation Factors	VIF
White Nose Syndrome	WNS

SUMMARY

This dissertation explores how policy processes and decision-making structures influence environmental management in public agencies. It contributes to our understanding of how traditional bureaucratic systems of organization overlap and integrate with collaborative management structures in both theory and practice.

First, it investigates the potential for Adaptive Management to take place within a bureaucratic system by examining a public agency's response to a pair of unforeseen environmental shocks as two endangered species of bat were discovered. Using a mixed-methods analysis, it qualitatively examines the agency's adaptive processes and extends the Adaptive Management model to describe mediating actors in the management process, then quantitatively tests the impact of this process using OLS regression, demonstrating that it significantly improves project outcomes at the agency.

Next, it examines how stakeholder engagement impacts management capacity and organizational decision-making at a public agency focused on sea turtle conservation. It examines the extent to which engaging local stakeholders increases the agency's ability to perform, the level of alignment between volunteer and professional managers' motivations, and the impact their motivations have on the decision-making process using a qualitative comparative case-study analysis. This study demonstrates that stakeholder engagement provides integral support to agency initiatives at the functional level and is critical to managerial ability, but that it introduces goal misalignment within the agency and can bias managers' decision-making through target fixation.

Finally, this dissertation investigates policy diffusion through the spread of state birdwatching trail programs across the US. This study challenges incumbent policy diffusion theory explaining diffusion through regional proximity and introduces a time-variant, micro-level mechanism to describe the spread of policy adoption. It tests this mechanism using fixed effects regression and demonstrates that special-interest group movement can more accurately model policy diffusion at a micro level.

This work contributes to our theoretical understanding of environmental policy and can be used by researchers investigating the process of administration of environmental services. Furthermore, it provides useful evidence that can inform practitioners tasked with designing or running environmental management programs in the field.

CHAPTER 1

INTRODUCTION

“Sometimes I think the surest sign that intelligent life exists elsewhere in the universe is that none of it has tried to contact us” (Watterson, B., 1991).

Few have been able to express our relationship with the natural environment with such eloquence and wit as Bill Watterson. His comments, couched in the comic strips of past daily papers, were always insightful and, when aimed towards environmental issues, often filled with a bitter humor describing our relationship with the natural world. We enjoy and rely on nature, yet we persist in financing its destruction. Without changing course, we will continue to see more and more environmental subjects go the way of Watterson’s derelict medium, the daily newspaper, degrading and eventually disappearing from the world. In the beginning, the earth may have been formless and void (Genesis 1:1, KJV), but that doesn’t mean we should attempt to return it to that state.

The health of any environment is critical to the well-being of its inhabitants. As humans, we rely on a diverse range of natural systems to provide ecoservices such as food production, water filtration, and waste detoxification (MEA, 2005; Kumar, 2010). We are tenants in a well-provisioned home. However, our impact on the environment around us has often been overextended in many areas, degrading these systems in many areas (Costanza et al., 2014). We methodically exploit the environmental systems around

us, undermining the ecoservices we rely on. We engage in careless destruction on countless fronts, depleting natural resources, degrading ecosystems, and endangering the long-term sustainability of many environments along with the communities that depend on them. The anthropogenic deterioration of environmental systems is widespread and often excessive; few ecosystems have been left undisturbed by humans (Kareiva et al., 2007; Tilman & Lehman, 2001; Vitousek et al., 1997). We have become disreputable tenants in our own home.

The impacts we have on the natural world are abundantly evident, yet our response is typically tepid and insufficient to successfully deal with the resulting problems. Deep-seeded attitudes and behavioral barriers prevent us from responding appropriately in many situations. We see ourselves as masters of nature, exogenous to the environment we live in, and therefore, unaffected by the changes we make to it. In reality, we are nothing of the sort. We are part of the environment, and in damaging it we are only hurting ourselves. To extend a bad metaphor, we have depleted the pantries, disassembled the furniture, and broken the thermostat of the house we are living in.

Appropriate environmental action requires a shift in perspective. We need to recognize that social and ecological systems are linked in order to understand the complex interrelations that govern their impacts on one another. Holistic models of Social-Ecological Systems (SES) that account for feedback mechanisms between social and environmental conditions (Berkes & Folke, 1998; Ostrom, 2007; Ostrom, 2009; Turner et al., 2003) offer a much richer approach to dealing with environmental issues. This type of conceptualization is critical to understanding how to address environmental issues in the face of anthropogenic impacts.

The conservation strategies we implement need to integrate multiple perspectives together, treating problems as both social and ecological dilemmas and designing policies that can address all aspects of the issue. Expanding our understanding of how social and ecological systems interact is crucial for designing appropriate conservation policies. In this dissertation, I investigate several interconnected policy questions concerning the structure and administration of environmental management through in SES context. This research can provide insight into developing more effective decision-making processes and policies for environmental conservation and can be of use to both researchers and practitioners working in this area.

CHAPTER 2

THE COMMON THREAD

Evan M. Mistur

2.1. Theoretical Framing

Environmental issues represent a growing concern in many areas around the world. Their importance is demonstrated by increasing public attention (Dunlap & Mertig, 2014) as activists and advocacy groups lobby for incisive change (e.g. Barnard, 2019) and an expanding list of United Nations meetings dedicated to reaching consensus on how to reduce ongoing degradation.¹ As anthropogenic inputs continue to change the climate (Griggs & Noguer, 2001), reshape environmental systems (Jenkins, 2003; Tilman & Lehman, 2001; Vitousek et al., 1997), and undermine ecosystem services (MEA, 2005), appropriate environmental policies are paramount. Careful insight and management are necessary to conserve natural resources and engage with the environment in more sustainable ways.

This will demand a shift toward more holistic thinking. Social and ecological systems are deeply interconnected with one another and cannot be considered in isolation (Berkes & Folke, 1998). Socio-economic and environmental subjects are often co-

¹ Major United Nations (UN) meetings include the UN Conference on the Human Environment (1972), World Commission on Environment and Development (1987), UN Conference on Environment and Development (1992), General Assembly Special Session on the Environment (1997), World Summit on Sustainable Development (2002), UN Sustainable Development Summit (2015), and UN Climate Change Conference (2019)

dependent and exist as connected parts of larger constellations of systems, governed by deep-seeded relationships and dynamic feedbacks (e.g. Díaz et al., 2006; Folke et al., 2016; Summers et al., 2012; Wu, 2013). Understanding how to interact with environmental subjects requires consideration of Social-Ecological Systems (see Figure 1) (Ostrom, 2007; Ostrom, 2009).

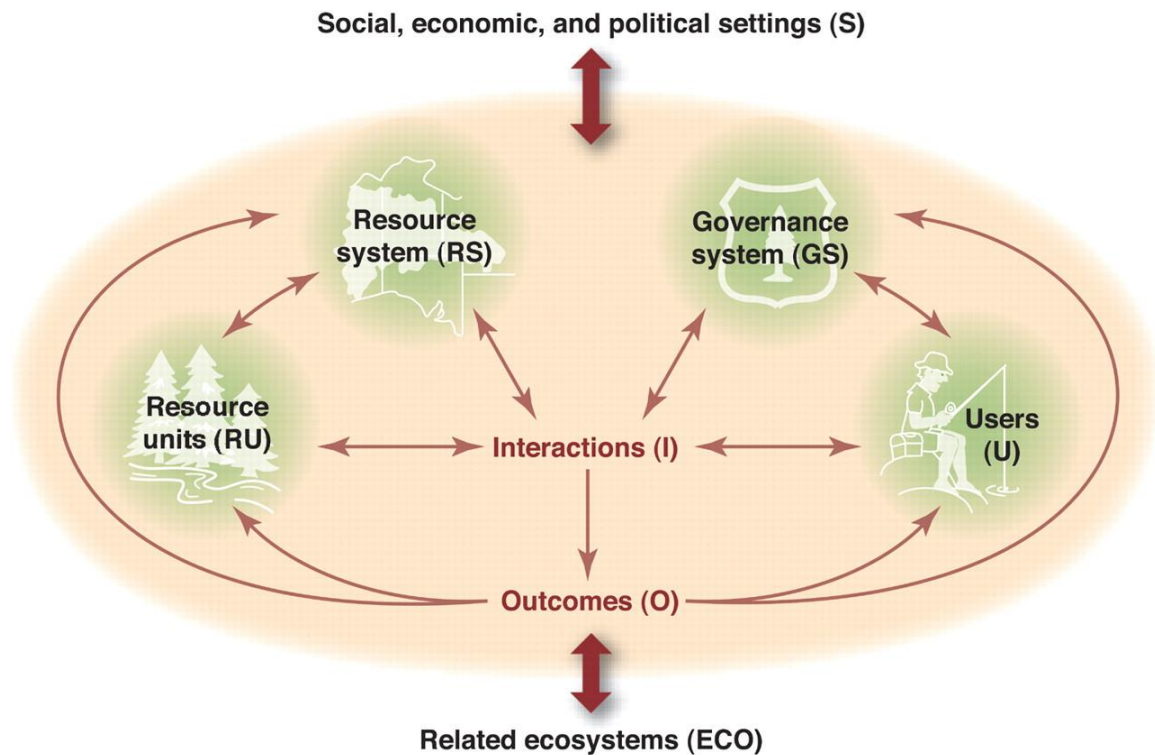


Figure 1: Social-Ecological System (SES) Model (Ostrom, 2009)

This conceptual framework provides the focus necessary to appropriately consider human-environment interactions and understand how to administer environmental management most effectively.

2.2. Stitching it all Together

This dissertation is focused on examining how environmental policy functions within the Social-Ecological System (SES) framework. In it, I analyze how policy processes and decision-making structures influence environmental management. This work contributes to our understanding of how traditional bureaucratic structures of organization overlap and integrate with alternative management strategies such as Adaptive Management and stakeholder engagement. It develops our understanding of how Adaptive Management functions within a bureaucratic setting, how stakeholder engagement can influence organizational decision-making, and how policies diffuse between agencies. The results will be useful for both researchers and practitioners focused on assessing how bureaucratic and collaborative environmental management systems interact.

Organizations are central to the administration of public services, including those focused on environmental conservation and management. As such, public administration is a critical point of connection in coupled SESs. Organizational structure is highly important to how administration functions. The design of an organization's decision-making processes heavily influences the type of decisions managers within that organization make, and consequently shapes organizational outcomes (Simon, 1957). Therefore, organizational decision-making processes help dictate how managers and policymakers interact with the subjects they are supervising, thus regulating an important area of exchange between social and ecological sides of the overall SES.

Extensive work in the literature is devoted to this subject (e.g. Simon, 1965; Kaufman, 1960) and provides well-developed explanations of many different decision-

making structures. Many researchers draw a dichotomy between top-down and bottom-up structures employed to implement policies (e.g. Innes & Booher, 2010; Weber, 2003; Weible et al., 2004) and examine the contrasting merits of hierarchical bureaucratic structures and collaborative systems (e.g. Agranoff & McGuire, 2003; Downs, 1967; Irvin & Stansbury, 2004).

Top-down, bureaucratic forms of organization are often promoted as effective administrative systems for ensuring the provision of non-market services (Downs, 1967). Imposing hierarchical authority systems, labor specialization, formal selection and orientation structures, and impersonal rules and regulations make bureaucracies effective providers of public services. Dating back to Weber, bureaucracy has been viewed as an ideal administrative structure, providing more efficiency and effectiveness than other alternatives (Weber, 1978; Weber, 2015).

However, structures designed to encourage bottom-up participation offer an alternative to traditional bureaucracy and have proliferated in practice (Rothchild & Russell, 1986). Deliberative organizational forms such as collaborative governance provide potentially advantageous alternatives to hierarchically oriented systems (Goldsmith & Eggers, 2004) since they allow management to be more flexible (Alter & Hage, 1993). These strategies are applied across a wide variety of situations and can provide numerous benefits (Emerson & Nabatchi, 2015). Participatory structures that promote collaboration can bring local knowledge and experience to the table (Andersson & Ostrom, 2008), providing better information inputs for managers (Reed et al., 2008). This can help foster social learning (Leach et al., 2013; Lejano & Ingram, 2009), build trust (Armitage et al., 2009; Olsson et al., 2004; Richards et al., 2004), and improve the

legitimacy of management outcomes (Sabatier et al., 2005). Critically, collaborative systems create different incentive structures for decision-makers, making them less prone to favoring conventional, risk-averse solutions than bureaucrats (Meier & O'Toole, 2006; Bozeman & Kingsley, 1998). This makes them excellent strategies for dealing with wicked problems (O'Toole, 1996) and sets them up for success when dealing with complex, dynamic subjects such as environmental systems that require diverse information inputs and flexible decision-making (Ansell & Gash, 2008; Reed, 2008).

Collaborative forms of organization can provide advantages over other systems (Huxham & MacDonald, 1992) and have been linked to positive outcomes indicating improved operational effectiveness over bureaucratic control (Doberstein, 2016; Agranoff & McGuire, 2003; Meier & O'Toole, 2003; Provan & Milward, 1995). This can lead to better environmental outcomes through more appropriate management in the long run (Beierle, 2002; Brody, 2003).

Despite the advantages bureaucracy and collaboration each provide, these strategies are typically viewed as incommensurable. Top-down bureaucratic structures and bottom-up collaborative systems are seen as dichotomous, creating an ongoing debate over which is the better administrative system. Critics of bureaucracy argue that it is too rigid and inflexible to successfully manage complex subjects such as environmental systems (Alter & Hage, 1993; Holling & Meffe, 1996). Conversely, its supporters contend that it is cheaper and more effective than participatory models (Weber, 1978) and criticize collaborative structures for its high transaction costs and propensity for biased decision outputs. Incorporating democratic participation into management is often assumed to be universally beneficial due to its normative appeal (McGuire, 2006), but it

can be costly and lead to negative management outcomes (Huxham, 2003). Furthermore, it can lead to power inequalities and open organizations up to group capture (Layzer, 2008). Collaborative strategies are difficult and should not be treated as a panacea for managers (McGuire, 2006).

This debate illustrates the pros and cons of both bureaucracy and collaboration, demonstrating the need for more diverse perspectives in environmental management. However, this is not the end of the story. These strategies are much more flexible than they are often presented as and can be used together with success (see Chapter 1). In this dissertation, I explore the areas in which bureaucracy and collaboration overall, examining how they function in tandem, analyzing the implications of their integration, and identifying when they are most appropriate to use for environmental management.

Understanding when and how to effectively use different administrative structures in environmental management is becoming increasingly important. Public agencies are continuing to be hollowed out (Milward & Provan, 2000) as provision of more and more public services are outsourced to decentralized networks of private suppliers (Goss, 2001). In the US, environmental agencies have been particularly prone to being hollowed out. Ongoing de-emphasis of environmental priorities has led to widespread downsizing of environmental agencies at both the federal and state level (EIP, 2019). This shift commonly translates to losses in budget, personnel, and resources for environmental managers, forcing them to adapt. Managers must find alternative tools and strategies to do their work (Milward & Provan, 2003). This has led to the implementation of a wide variety of administrative approaches to deliver services across different sectors (Elliott & Salamon, 2002; Emerson & Nabatchi, 2015; Kettle, 2006). Analysis of these strategies is

critical in order to understand the impacts they will have on both social actors and the environmental subjects they interact with, then determine how to best put them into practice.

2.3. Dissertation Roadmap

In this dissertation, I start to explore these questions, examining the extent to which collaboration is commensurable with bureaucracy, how top-down and bottom-up processes integrate, and how these interactions impact organizational decision-making. In chapter 2, I analyze the potential for Adaptive Management within a bureaucratic structure by examining a public agency's response to a pair of unforeseen environmental shocks, demonstrating that these systems are more amenable than previously thought and showing that their integration can improve organizational outcomes. In chapter 3, I examine how stakeholder engagement impacts management capacity and organizational decision-making at a public agency focused on sea turtle conservation and observe that, while stakeholder engagement can be highly beneficial to organizational capacity, it can create downsides as well, biasing decision-making through target fixation. Finally, in chapter 4, I investigate policy diffusion through the spread of state birdwatching trail programs throughout the US and show that policy diffusion spreads through special-interest group movement by developing and testing a time-variant, micro-level mechanisms of diffusion. These results can help inform our understanding of environmental policy structures and inform our choices when making decisions about how to organize environmental management.

CHAPTER 3

LET SLEEPING BATS LIE: ANALYZING INSTITUTIONAL ADAPTATION TO ENVIRONMENTAL REGULATORY CHANGE THROUGH ADAPTIVE MANAGEMENT THEORY

Evan M. Mistur, Gordon Kingsley, Daniel C. Matisoff, Yehyun An

3.1. Introduction

State transportation agencies frequently encounter unexpected changes in the environmental and regulatory conditions surrounding their projects' environmental assessments (Amekudzi & Meyer, 2005; Landres et al., 1999). How they adapt to these shocks can be a key factor in determining how environmental concerns are addressed in infrastructure projects (such as roads, bridges, and ports) as well as how long those projects take to complete. Adaptive Management (AM) is a strategy that uses collaboration and experimentation to generate learning. AM provides a theoretical foundation for understanding agency behavior and performance under conditions of high uncertainty such as those created by environmental shocks (Norton, 2003; 2005). However, current formulations of AM do not fully address increasingly popular New Public Management (NPM) practices which emphasize greater reliance upon market forces and business strategies drawn from the private sector (Barzelay, 2001). We present a case study of the Georgia Department of Transportation (GDOT) as it responded to a series of environmental shocks stemming from discoveries of endangered bats within its jurisdiction. When endangered species were detected in the local environment, normal operations at GDOT were disrupted and mediation was required in order to determine how they should be dealt

with on ongoing projects. We focus on how GDOT uses other mediating actors, primarily environmental consultants, to assist in the development of compliance procedures.

AM is often presented as an alternative, and better, approach of environmental management than the structured procedures associated with traditional command and control bureaucracy (Norton, 2015; Holling & Meffe, 1996; Gunderson, 2001a). By observing the use of two common NPM practices, outsourcing (contracting out environmental analyses to private consultants) and performance measurement (monitoring the time taken to get projects approved), we explore the robustness of AM theory in explaining bureaucratic behavioral outcomes.

AM prescribes that policy-makers and their agents should test ambiguities and conflicts which arise due to environmental uncertainty through an iterative decision-making process coupled with rigorous monitoring of environmental performance (Williams, 2011a). AM often includes processes for greater democratic engagement with stakeholders as a means of better articulating the competing values associated with an environmental shock (Norton, 2005). It is commonly integrated in collaborative governance, a system of organization focused on incorporating agents and stakeholders from diverse perspectives in the decision-making process (Ansell & Gash, 2008; Innes & Booher, 2004; McGuire, 2006). NPM and more recent movements in administration, such as New Public Service (NPS) (Denhardt & Denhardt, 2007) are also based on prescriptive theories about how management should be conducted. NPM argues for the incorporation of private sector, incentives-based management into the public sector (Hood, 1991). NPS builds off of this, emphasizing attention to elements of collaborative governance such as democratic values (Bryson et al., 2014). Though they prioritize different goals, these

strategies can be commensurable with one another. NPM's emphasis on outsourcing can facilitate elements of collaboration promoted by NPS and collaborative governance. Furthermore, its recommendations for rigorous performance review and feedback from stakeholders (or clients in NPM language) are similar to the monitoring and feedback systems in AM.

Similar to many other public agencies in the US, state departments of transportation (SDOTs) rely heavily on performance review (Poister, 1997), and have increasingly expanded their use of consultants (Warne, 2003). Environmental analysts at these agencies organize environmental processes and facilitate project management at the state and federal levels with these external consultants. The consultants themselves might be viewed as having several different roles. First, they might be viewed as agents of the department, providing labor to complete the information needs of bureaucracy. In this context, consultants may be responsible for performing the technical studies and National Environmental Policy Act (NEPA) documentation necessary for environmental approval. Second, they might be considered scientific and technical specialists who apply their expertise to provide a detailed understanding of local conditions, which agency analysts may be too removed to observe. Third, consultants might mediate collaboration between various stakeholders in the decision-making process. These consultants function as mediating actors by brokering collaboration between bureaucratic agents at GDOT, local governments, regulators, research communities, and local stakeholders. We study these three roles that environmental consultants play over a series of transportation projects, examining the relationship between iterative learning processes and the development of bureaucratic compliance procedures. Current formulations of AM do not model

collaboration and adaptation as commensurable with bureaucratic organization or account for the role outsourcing plays in the adaptive process. However, when we account for NPM and collaborative practices in our case study, we observe a more complicated relationship between adaptive and bureaucratic processes. After the regulatory landscape changed, GDOT maintained the hierarchical structure typical of a bureaucratic organization. However, it engaged in structural adaptation with the consulting community, shifting its relationships to provide consultants with input into how to respond to the new regulations. Furthermore, members of the consulting community adapted to the market, deciding whether to specialize in bats themselves and act as mediating agents for GDOT in dealing with the issue, or defer to other firms, subcontracting bat-related work out to their peers. This altered individual firms' relationships with GDOT and each other. The complexity of these relationships, and the mediating role consultants had the flexibility to maintain, allowed adaptation to occur within the overall bureaucratic architecture at GDOT.

Section 2 reviews the existing literature concerning AM, then describes the specific context for AM at GDOT. Section 3 describes the case context, our data, and research methodology. Section 4 investigates our results, first describing AM engagement by GDOT and detailing the ways in which it deviates from the AM model, and then quantitatively evaluating the impact that this management strategy had on project outcomes. Section 5 suggests improvements to the AM model, and discusses the policy implications of our research. Section 6 reviews our conclusions.

3.2. Adaptive Management Models

Traditional command and control approaches to management have been criticized as ineffective for environmental subjects (Holling & Meffe, 1996). Top-down methods often result in unexpected drawbacks for both human and natural resources due to inflexibility of the bureaucratic structure. For SDOTs, the importance of maintaining project schedules and budgets can drive management behavior. However, management strategies that focus on understanding the complex environment in which their operations are embedded are better suited for adapting to uncertain conditions because they account for the entire system rather than a single variable which may not be well defined (Gunderson, 2001b; Norton, 2015).

AM was developed as a process for resource supervision which facilitates learning and is particularly useful for problems that can be described as “wicked” (Rittel & Webber, 1973; Walters & Hilborn, 1978). This strategy is an effective method of management for natural resources (Freeman, 2010; Norton, 2005). It provides a method for managing subjects under uncertainty by treating them as natural experiments in order to sort through rival theories of ecosystem variation (Gunderson, 2001b). Situations which exist under uncertainty, have spatial or temporal variation, require cost-benefit analyses, or are constrained to institutional or stakeholder requirements, all justify the use of AM (Gregory et al., 2006). It can be employed in any situation where management could realistically be improved by reducing uncertainty (Williams, 2011b).

When managers determine their initial goals and then iteratively alter their decisions in order to learn how to improve management outcomes within the context of their specific environment, their behavior is consistent with AM. This marks a departure

from most public management theories where agencies negotiate organizational goals that then set the parameters for acceptable decision-making and performance at the project level (Rainey, 2014).

Early conceptualizations of AM divide the process into two phases of behavior (Nichols et al., 2007), which we incorporate into our study. Managers first focus on *goal determination* (the process of making decisions about how a subject should be managed) using multi-partner collaboration. This creates an arena for discourse involving potentially conflicting values and methodological ideas. *Goal determination* is characterized by collaboration between public officials, scientific and technical specialists, and other stakeholders. For state transportation projects, the goal determination group consists of representatives from federal and state regulatory agencies, local governments, SDOT staff, and consultants working for the SDOT.

In cases of environmental shock, an AM process may begin at the project level and build over time toward a larger organizational goal setting process as knowledge from different projects accrues in an iterative fashion. The collaborative, and in some cases democratic, aspect of goal setting draws in knowledge across a range of disciplines and ideologies to form management goals and objectives (Norton, 2015). *Iterative management* can then take place as managers evaluate how close each project comes to meeting their objectives and integrating what they learned from that success (or failure) into the next round of goal setting. By not stating firm organizational goals up front, agencies can prioritize between management alternatives by weighing their success against each other (Burgman, 2005).

Figure 2 provides a depiction of the relationship between *goal determination* and *iterative management*, as adapted from Williams (2011a). AM is marked by the presence of multi-partner collaboration and the formation of measurable objectives, decision-making in the face of uncertainty, monitoring and assessment to reduce that uncertainty, learning, and iterative decision-making over time.

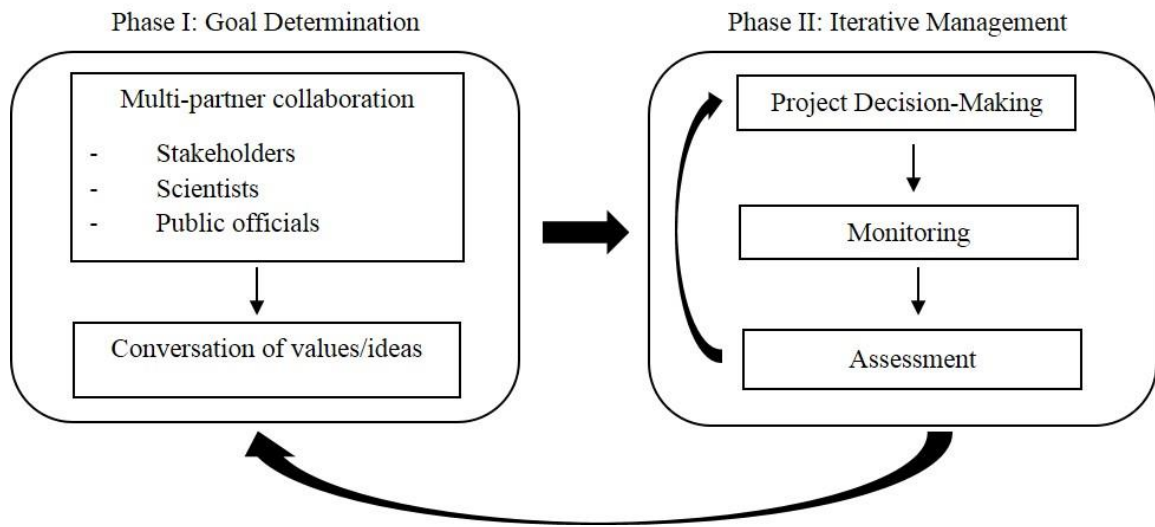


Figure 2: Adaptive Management Model

Process of goal determination and iterative management

For an agency dealing with an environmental shock, the portfolio of projects considered during the *goal determination* phase will be defined by the physical and regulatory conditions set by the event (i.e. which jurisdictions contain relevant habitat) and the uncertainty associated with how widespread those conditions might apply. An affected agency may develop sets of projects within this portfolio purposively to experiment with or treat them all the same at the organizational level, opportunistically relying on the adaptation of its consultants to generate learning at the project level.

3.3. A Mixed Methods Analysis of Adaptation to Environmental Shocks

We use a mixed methods design, developing a case study of managerial adaptations with an embedded statistical analysis. This allows us to examine 1) the extent to which GDOT's adaptive strategy reflects the iterative processes of AM, and 2) the impact that strategy had on project durations.

We develop the illustrative case study design using the conceptual elements of AM described in Figure 2 to explore whether consultants contribute to *goal determination* and/or *iterative management* at GDOT. This case study focuses on the environmental review phase of infrastructure projects because this is when agencies are most engaged in identifying and developing plans to mitigate environmental shocks. We examine three different ways consultants might contribute to AM at GDOT. First, we examine changes in procedures at GDOT and consulting firms aimed at improving GDOT's ability to identify endangered bat habitat and mitigate damage. Second, we inspect the interaction and communication consultants shared with a variety of actors involved in deliberating how to react to a shock. Third, we explore whether learning generated by consultants carried over to subsequent shocks.

The case study elements of our design organize data temporally into *adaptive events* associated with the discovery of two endangered bat species which were previously unknown to the region, as well as the exposure of indigenous bats to White Nose Syndrome (WNS) which has proven an existential threat to bat species in other regions of the US (Blehert & Meteyer, 2011; Frick et al., 2010; WNS.org, 2018). An *adaptive event* is the introduction of an environmental shock and the regulatory changes it brings for a set of

projects, demanding the development of *goal determination* through *iterative management* in order to adapt. The emergence of each *adaptive event* is observed at two levels of behavior. First, we track *goal determination* at the organization level by investigating how GDOT developed guidance about how to adapt to each bat species. Second, we observe feedback from consultants at the project level, giving us a window onto the *iterative management* of each event. We also explore the relationship between *goal determination* and *iterative management* over time.

The qualitative analysis of our case study draws from a mix of archival and interview data. Archival data are sourced from federal and state guidance documents regarding bats and environmental review. We examine a series of 11 GDOT announcements and emails (called email blasts) about bats. The primary purpose of both the emails and announcements was to disseminate up-to-date information about new regulations and procedures to GDOT ecological officers and the consultants who work with them. However, they served not only as a medium through which GDOT could circulate instructions, but as a conduit for ecologists to take part in the ongoing discussion between GDOT and the environmental regulatory agencies it had to answer to. These data give us a strong, if not complete, representation of the general announcements GDOT made during this time. Many of the relevant project-specific discussions were conducted across different media (e.g. phone conversations and in-person meetings) so we do not have an exhaustive collection of communication data, but our sample offers a representative look into what took place. We also analyze a GDOT spreadsheet predicting the scope of impact the regulatory change would have on future projects at the time of the shock. This document

contains information on the number of projects GDOT predicted would be impacted as well as their budget.

Interview data about GDOT practices, consultant relationships, and challenges to environmental projects were gathered between October 2015 and June 2016 from consultants and GDOT staff including office managers, analysts, and ecological specialists. Both semi-structured and unstructured interviews were conducted with GDOT staff, including conversations with the ecological specialist charged with developing new regulatory guidance on bats throughout the adaptive events we cover. We also interviewed nine representatives at six (17%) of GDOT's environmental consulting firms, chosen based on performance-based selection criteria. The semi-structured interview protocol we used was designed to explore how communication and organization between GDOT staff and consultants contribute to performance outcomes, and covered topics related to both changes in goal determination and iterative management.

The statistical analysis embedded within our case study is designed to test the impact GDOT's strategy (as revealed by the qualitative analysis) had on project durations. First, since environmental shocks can be disruptive of production schedules and the *duration* of infrastructure projects, we examine the *adaptive performance* of GDOT in terms of the time it took for the environmental review process to be completed in the portfolio of projects associated with each *adaptive event*. Second, we examine the relationship between similar *adaptive events* which occurred at different points in time. One indication of learning that we explore is whether the disruptions to project schedules were reduced between subsequent *adaptive events* as GDOT applied the lessons learned from one environmental shock to the next. Since GDOT's goal was to eliminate delays

caused by the new regulations, we consider any reduction in project durations to indicate effective management.

Performance data relevant to iterative management come from a GDOT database which provides the duration of the environmental review process for each project completed between 2011 and 2015. This database is designed to track the schedule for tasks associated with the engineering design for infrastructure projects as well as the tasks associated with projects' environmental review. It is comprised of calendar dates marking when tasks were initiated and completed. These dates do not represent the actual time spent on task by GDOT officers or their consultants. Instead, they are measures of time in process which include the time devoted to adaptations occurring around regulatory changes.

Our analysis focuses on the population of 81 bridge projects included in the sample of 429 total GDOT projects within the cleaned dataset. We chose to examine bridge projects since bridges often provide habitat for bats to roost making those projects much more susceptible to the influence of bats (Keeley & Tuttle, 1999; Davis & Cockrum, 1963). This subset should present the clearest picture of the impact these *adaptive events* had on GDOT. Additionally, we control for the wide variation in project durations due to different project characteristics by including NEPA classification, project type, funding source, and staff experience in our model. Of the 81 bridge projects in this subset, 11 were interrupted by the first *adaptive event* (Indiana Bats) and 10 were interrupted by the second (Gray Bats). The distribution of cases is depicted in Table 1.

Whether or not a project was interrupted by each *adaptive event* is included as a pair of dummy variables called "Indiana Bat" and "Gray Bat" after the shock they represent and coded 1 for projects which were ongoing at the time of each event. Interrupted projects

were subjected to the disruptions associated with that event. We expect projects to have longer durations if they were interrupted by either *adaptive event*, but we anticipate a smaller impact from the second event due to agency adaptation occurring in response to the initial shock. Lead time was coded as the number of days after the initial *adaptive event* that each project started. This variable is meant to capture the agency's ability to adapt. If GDOT was effectively adapting, then the more lead time it had available to learn about bats the more expediently it should have been able to complete its projects. We expect project durations to decrease the more lead time a project has had since it would provide GDOT additional opportunity to engage in adaptation.

Table 1: Distribution of Projects

Number of cases in each category from the population of bridge projects

	Uninterrupted	Indiana Bat	Gray Bat
Completed Before Interruptions	24	0	0
Concurrent	31	11	10
Started After Interruptions	14	0	0

**9 projects were interrupted by both shocks*

NEPA classification and project type can drive project durations through the varying level of complexity each type entails, so we include them as dummy variables with Categorical Exclusions (CE) and Bridge Rehabilitation projects as their respective reference groups.² Funding source is included as a dummy variable, coded 0 for local and

² National Environmental Policy Act (NEPA) classifications include Categorical Exclusions (CE), Environmental Assessments (EA), and Environmental Impact Statements (EIS) in order of increasing complexity. No EIS projects are present in our dataset.

1 for state funding since projects which are funded locally are subject to a different set of organizational constraints (and often delays) than those run by GDOT. Staff experience can impact the efficiency with which projects are completed and is represented by a trio of dummy variables (for the project's manager, NEPA analyst, and ecologist) each coded 1 for staff who have more than the mean number of projects at their position. The dependent variable, environmental review duration, is measured in days and represents the period of time from the beginning of a project's environmental studies to the end of the review process when it is approved. This measure of project length is used as an indicator of adaptation; the more successfully GDOT was able to adaptively manage bats on each project, the more efficiently it should be able to complete that project. The dependent and explanatory variables in our model are summarized along with basic descriptive statistics in Table 2.

Using Ordinary Least Squares (OLS) multivariate regression in Stata v14.2, we analyze the impact of each *adaptive event* on project durations. We use this analysis to test the adaptive capability of GDOT by examining whether it was able to recover from these disruptions over time. The models we present are the most parsimonious, simple, and interpretable, and are consistent with a variety of robustness checks and alternative specifications. We tested for multicollinearity using variance inflation factors (VIF).³ We also used a series of F-tests and stepwise functions to assess different model specifications, comparing different models with Akaike's Information Criterion (AIC) (Akaike, 1974). Furthermore, we tested the robustness of our models using bootstrapping at 100, 500 and

³ We ensured that none of our independent variables had a VIF exceeding 2.

1000 iterations and comparison with structural equation models to account for potential latent variables and correlations between error terms in the data.

Table 2: Variables

Summary and descriptive statistics

Variable	Measure	Descriptive Statistics
Environmental Review Duration	Days until project completion	Mean = 1385 Std. Dev. = 1267
Indiana Bat	0 = Uninterrupted, 1 = Interrupted by Indiana Bats	Interrupted = 13.6%
Gray Bat	0 = Uninterrupted, 1 = Interrupted by Gray Bats	Interrupted = 12.4%
Lead Time	Days between initial adaptive event and project's start date	Mean = 85 Std. Dev. = 216
Project Type	0 = Bridge Rehabilitation 1 = Bridge Replacement	Rehab = 3.7% Replace = 96.3 %
NEPA Type	0 = Categorical Exclusion (CE) 1 = Environmental Assessment (EA)	CE = 91.4% EA = 8.6%
State Sponsor	0 = Local funding source, 1 = State funding	State = 81.5%
Experienced PM	1 = Project Manager has more than average number of projects	Experienced = 14.8%
Experienced NEPA Analyst	1 = Project NEPA Analyst has more than average number of projects	Experienced = 39.5%
Experienced Ecologist	1 = Project Ecologist has more than average number of projects	Experienced = 34.6%

3.4. Results

3.4.1 Adaptive Management Process at GDOT

This section presents the context of our case study, describes the sequence of events surrounding the discovery of endangered bats and the regulatory changes that followed, and lays out evidence for GDOT's use of AM to deal with this environmental shock. Figure 3 details a timeline of events at GDOT.

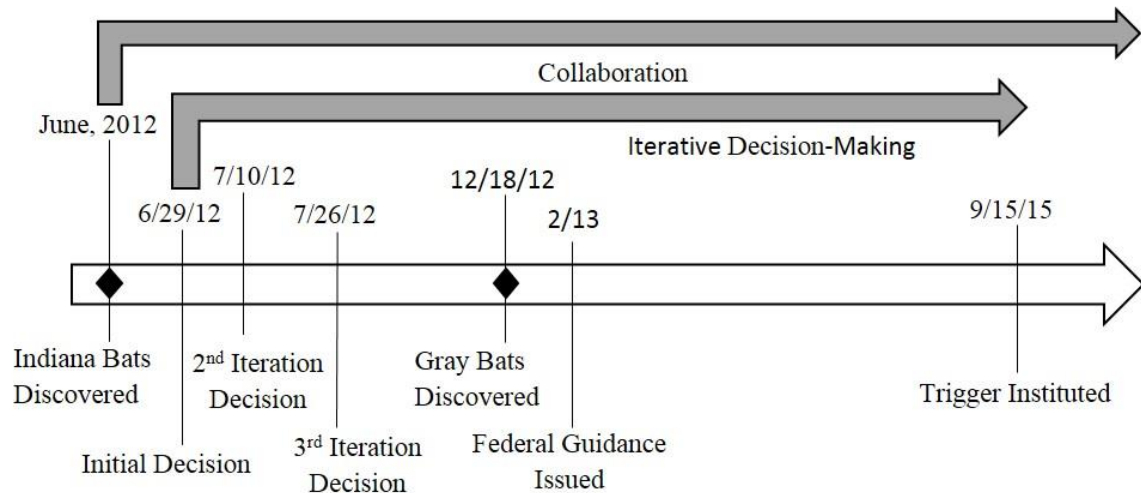


Figure 3: Timeline

Sequence of events at GDOT

Prior to 2012, 14 different species of bats were known to live in Georgia. Transportation agents would have to be aware of these species when preparing their NEPA reviews since one was listed as threatened and several others were of state concern.⁴

⁴ Threatened Species: Northern Long-eared Bat. Species of Concern: Northern Yellow Bat, Southeastern Myotis, Eastern Small-footed Myotis, Little Brown Myotis, and Tri-colored Bat.

However, since none of these bats were classified as endangered under the Endangered Species Act of 1973 (ESA) GDOT was not forced to comply with any ESA regulations for bats, and was, therefore, much less concerned about the impact its infrastructure projects had on local populations (ESA, 1973).

That changed in June of 2012 when a fifteenth species, the Indiana Bat (*Myotis sodalis*), was discovered inside GDOT's jurisdiction. This is the first of two *adaptive events* we observe in this case study. Indiana Bats have been protected at the federal level since 1967 when they were first listed under the Endangered Species Preservation Act of 1966 and are currently listed as endangered under the ESA (ESPA, 1966; ESA, 1973). Their detection in Georgia prompted ESA regulations for bats to be extended into areas where no such compliance was previously required. This was coupled with a new threat to local bat species since Indiana Bats are carriers of WNS, a fungal disease which has been rapidly spreading through the US, decimating populations of hibernating bats. Population losses in the Northeast, where the disease was first detected, are estimated at roughly 80% (USGS, 2017). For GDOT, this meant that every project taking place within its northern counties had to start complying with a brand new set of unfamiliar regulations.

ESA regulations are administered jointly by the US Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) which operate as two of the regulators with federal authority in the NEPA process (USFWS, 2017). They institute strict requirements in areas where endangered species are present in order to avoid adverse effects on those populations. These include restrictions on the types of actions which can be taken, and the demand for detailed monitoring, determinations, documentation, and permitting on top of the NEPA process' baseline requirements (EPA, 2005).

This shock was reported as being highly disruptive to GDOT projects in both consultant and GDOT staff interviews. Finding Indiana Bat habitat within GDOT's jurisdiction brought both uncertainty and ambiguity to its environmental review process. Not only was it impossible to determine where individuals of those species would turn up, but it was not immediately clear how they should be dealt with if, and when, they did. Since federal regulations did not specify the best way to survey for Indiana Bats, GDOT had to determine the best method of dealing with them in its regional context out of a long list of possibilities. GDOT staff interviews revealed that the *goal determination* phase involved decision-making about how to specify species ranges and detect bats on-site in Georgia, as well as how to determine the impact projects would have on local bats and translate that into a technical assessment for the review. This phase engaged multiple actors and was an ongoing process culminating in reformations of GDOT goals as learning and feedback were generated through the *iterative management* of individual projects. GDOT responded to this shock by implementing a form of AM within the hierarchical structure of authority demanded by the NEPA process. The tasks involved in the transition from an initial to a final *goal determination* through *iterative management* at GDOT is described in the archival evidence we present and presented visually in Figure 4.

GDOT engaged in collaboration, initial decision-making in the face of uncertainty, and iterative learning to implement adaptation. It responded to the lack of clarity surrounding the environmental shock by initiating discussion with both federal regulators and its consultants. Archived emails clearly show collaborative decision-making taking place throughout this conversation. GDOT used email to transmit information to its

consultants from an ongoing conversation with federal regulators about what types of management changes would be required by the presence of bats.

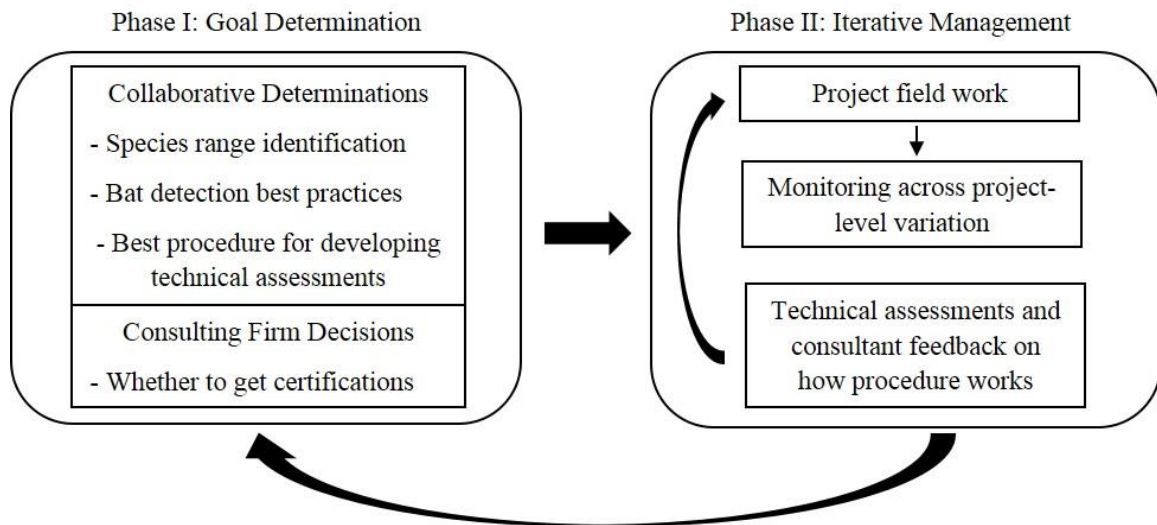


Figure 4: Adaptive Management at GDOT

Main tasks involved in goal determination and iterative management at GDOT

Simultaneously, it used the discussion to gather information from those consultants about conditions in the field. While archival evidence shows that consultants were not formally included in this discussion until June 29th, 2012, when the first set of guidelines were published, we know from consultant interviews that they frequently discuss such guidelines independently with both GDOT and federal regulatory agencies and were thus informally involved in the *goal determination* process.

*Fri, 29 Jun 2012 21:09:46 “Ecology Update: Indiana Bat (Myotis sodalis)”:
“We’re still working with USFWS, DNR [Department of Natural Resources], and
FHWA [Federal Highway Administration] to determine how to translate what you
find in the field into an effect determination.”*

GDOT used this conversation as part of the larger *goal determination* phase of the AM process. It enabled GDOT to think through how the regulations should be applied within Georgia and what the best methods of compliance would be. Although the

discussion was a collaborative effort between three different groups of actors, it took place within the structure of a top-down system.⁵

After coming to an agreement with federal regulators, GDOT published an initial set of procedural guidelines and range maps for their consultants and ecological staff to use. On June 29th, 2012, after about a month of discussion (according to archival and interview evidence), a set of standards regarding Indiana bats was put in place even though GDOT was unsure about how this approach would work in the field.

Fri, 29 Jun 2012 21:09:46 "Ecology Update: Indiana Bat (Myotis sodalis)": "The USFWS has taken this finding to mean that north Georgia is likely within the summer range, and that we need to begin considering project's potential effects on ibat [Indiana bat]. This goes into effect immediately."

This announcement provided GDOT ecologists and its consultants with a preliminary map depicting the regulator's best guess as to where Indiana Bats' range spread as well as basic instructions about how to look for them within that range. GDOT explicitly expressed that these instructions were not final and would be improved later through *iterative management*. The designer of the draft range map had very little information about how far the species actually spread; his map was an exercise in educated guesswork.

Fri, 29 Jun 2012 21:09:46 "Ecology Update: Indiana Bat (Myotis sodalis)": "For now, the ibat should be considered in all of the counties within the proposed range, but keep in mind that this is just a draft range that may change. I know he struggled to define the range, given that so little is known."

GDOT never intended their procedures or range maps to be static; they were considered rough drafts which would be refined as more was learned about bats. At that

⁵ Local stakeholders were not included in the goal determination phase, but they could give indirect feedback through their interaction with GDOT agents and consultants during the required public stage (the set of hearings open to the public for locals to engage in discussion about the project) of the NEPA process.

point, GDOT relied heavily on procedures developed by other SDOTs from states where Indiana Bats are commonly found, but it always intended to create a specialized procedure for its own context. Compliant with AM, an initial decision was put in place and treated as a hypothesis about how Indiana Bats ought to be dealt within Georgia. It was intended to yield the best result given the limited information available at the time, but it was designed to be flexible to new information should it arise.

The consultants doing field work on bat-related projects were expected to carry out these procedures as GDOT agents, but they were also relied upon as monitors for how well those procedures were working at the project level. As the consultants learned about where Indiana Bats were and how to deal with them in the field they transmitted information back to GDOT which adapted its procedures and maps accordingly. This feedback allowed GDOT to test the hypotheses (i.e. bat range, survey practices, and procedural guidelines) it developed during the *goal-determination* phase and revise them over time through *iterative management*. Each GDOT project can be seen as a single iteration of environmental management. GDOT decisions made during the *goal determination* phase inform its staff and consultants about how to deal with bats at the project-level within each specific site's ecological context. The monitoring and feedback consultants provide at the project level generates knowledge which GDOT can use to update or revise its guidelines in coordination with federal regulators.

As indicated by GDOT staff interviews, the ecological consultants were able to provide some key information about Indiana Bats by surveying for them within the initial range ascribed to that species. The consultants found that bats were not in many of the places they expected them to be. Even though the environmental regulatory agencies had

established a range and were considering expanding it GDOT used evidence from the consultants' field work to explain why that should not be done. As early as July 10th, 2012 this information was used to refine the range map being used and procedures for making bat surveys more precise were developed. Then on July 26th a full second draft of the map was published which improved the bat ranges even more.

Thu, 26 Jul 2012 18:48:02 "Ecology Update: Indiana Bat (Myotis sodalis)": "Indiana bat update: FWS has revised the draft range map. The new map does not change the proposed 'netting' area (cross-hatched), but expands slightly on the summer range (heavy red border) to include the entirety of any county touched."

This pattern of behavior indicates multi-level participation in dynamic learning. GDOT goals were revised as learning was generated through *iterative management* of individual projects. In order to facilitate this process, GDOT actively requested feedback from its consultants. The technical observations consultants made while in the field proved invaluable for both GDOT and the federal regulators. This learning allowed GDOT to improve its *adaptive performance* by absorbing the shock of the Indiana Bat discovery.

The regulations being implemented were never up for debate. GDOT, as well as the consultants working for it, had to comply. In this way, the overarching goals at stake (i.e. preservation of the endangered bat species being dealt with) were not included in the state level *goal determination* process. This process only included how best to achieve those overarching goals within the context of a new state. However, GDOT was given leeway within the overall command and control structure to adapt to the regulatory policies within its own context. Broad rules about what needed to be done were handed down through an authoritative hierarchy, but the rulemaking agencies relied on bottom-up feedback and technical advice from GDOT and its consultants to inform how those goals should be accomplished. The regulators were not simply mandating requirements for GDOT but were

relying on its input in order to determine what to do. GDOT itself had the same relationship with its consultants. Each institution relied on feedback and technical learning from the group that was responsible to it in order to learn about the environmental problem.

Tue, 18 Dec 2012 22:10:08 "Gray Bat Section 7 Range": "Coordination with NEPA staff about the requirements is also recommended so that FHWA does not receive documents that we cannot approve [because of inconsistencies with the ecology report]."

At the same time, many consulting firms GDOT uses scrambled to catch up to the new bat regulations by acquiring the certifications and permits required to conduct surveys on endangered species. Many firms acquired these certifications after the ESA regulations came into effect since they were never needed before. At the outset of the case study, the incidence of endangered bat species was so rare few consulting engineering firms had the necessary certifications to conduct the analysis. However, by its end (a five-year window), both GDOT and its consultants had adapted to monitoring multiple species.

3.4.2. Adaptive Management and Performance

The primary goals for an SDOT infrastructure project are associated with meeting transportation needs while performing the project on schedule and on budget. However, each infrastructure project must also comply with the NEPA process requiring environmental studies of air, water, and noise pollution, ecological impacts on habitat and species, as well as cultural and historic conditions associated with a site (Bass & Bogdan, 2001; Eccleston, 1999). The nature of the environmental review can have a profound effect on the intensity of the negotiations, and the levels of collaboration and conflict that take place during the project's *goal determination* phase. This, in turn, shapes the length of time taken to design and build an infrastructure asset for a state government. The goals

prescribed for each state transportation project are heavily shaped by the agency's interaction with federal and state regulatory authorities who are the primary source of guidance for environmental compliance.

The first *adaptive event*, the discovery of Indiana bats, had a substantial impact on project performance. It required a steep learning curve for GDOT agents who had to determine how to address the new regulations despite not knowing exactly how they would work within the state's unique ecological context, find the best way to figure out how far the species' range extended, and then decide how best to communicate guidance to the consultants who would be doing the work required for compliance in the field. GDOT generated the knowledge necessary to overcome the learning curve associated with Indiana Bats opportunistically through its consultants' experience in the field. Rather than setting aside a subset of affected projects to experiment on, it relied on project-level variation experienced by its consultants to produce knowledge about how best to deal with the new bats. In addition, GDOT and consulting ecologists had to scramble to learn, and get certified for, the various surveying and monitoring techniques that the new regulations required.

In the statistical analysis embedded within our case study, we regress environmental review duration on two multivariate models to analyze the impact of the two adaptive events and assess GDOT's *adaptive performance*. The results are included in Table 3. As depicted in model 1, the environmental review process took significantly longer to complete for projects which had to deal with the first *adaptive event*, the introduction of Indiana Bats. They required about 766 additional days for completion.

Table 3: Regression Results*Output for two multivariate models assessing the impact of two adaptive events*

n	81		81	
R-squared	0.3524		0.3168	
Variables	Model 1		Model 2	
Environmental Review Duration	<i>Coef.</i>	<i>Std. Err.</i>	<i>Coef.</i>	<i>Std. Err.</i>
Indiana Bat	765.69**	368.567	-	-
Gray Bat	-	-	226.26	392.218
Lead Time	-1.18**	0.589	-1.37**	0.601
Bridge Replacement	-629.85	657.028	-515.87	673.477
EA	1744.01***	443.947	1666.86***	455.357
State Sponsor	-480.59	323.421	-436.10	331.786
Experienced PM	-433.89	349.768	-359.61	360.144
Experienced NEPA Analyst	248.04	251.122	281.01	258.716
Experienced Ecologist	358.75	272.867	296.37	280.267
Constant	2070.69***	777.372	2536.92*	1429.014

*** p<0.01, ** p<0.05, *p<0.1

When the shock first took place GDOT was unsure about how to deal with it. Some projects were impacted much more seriously than others making it difficult to predict where delays might take place. This was exacerbated by the set of new certifications and necessary skills required for consultants to deal with endangered bats in the field. Many of GDOT's consultants had to update their certifications and staff training before proceeding with their project or resolve how to integrate a certified firm as a sub-contractor. Until the technical expertise was in place, GDOT projects would have to be put on hold, delaying them until consultants met the requirements necessary to complete their surveys.

However, GDOT reduced this uncertainty by engaging in adaptation over iterative decisions as consultants tested their efficacy in the field. We learned from GDOT staff and

consultant interviews that consultants cooperated with both GDOT and federal regulatory agencies directly. This cooperation facilitated learning about bats because it gave state and federal agencies access to project-level knowledge. This enabled GDOT to refine its management strategies over time and increase its performance by reacting to the shock and absorbing some of the disruption it had initially caused. Over time, project review durations gradually became shorter again as the shock became further removed and more was learned about the new species of bat.

We study the *adaptive performance* of GDOT by examining whether its *iterative management* resulted in decreased environmental review durations over time. The regression results show a significant decrease in project durations as lead time increases showing adaptation taking place. In this sample, projects were completed about 1.2 days faster for each additional day GDOT had available to adapt before starting. The strength of these results is limited by the small number of observations in our study and the large standard errors of many of the parameter estimates in our model, but they support the narrative from our qualitative analysis. This evidence indicates that adaptation was taking place at GDOT.

Six months after the discovery of Indiana Bats, a second species of bat, the Gray Bat (*myotis grisescens*), was detected in north Georgia. This species is also endangered and resulted in a second *adaptive event* for GDOT. Gray Bats have been listed as endangered since 1976 and require compliance to the same set of regulations as Indiana Bats (ESA, 1973). This species is different from the first endangered species of bat encountered by GDOT in that it prefers roosting in caves rather than trees and occupies a distinct geographical region from the Indiana Bat, even though the two ranges overlap

considerably (USFWS, 2017). However, this *adaptive event* was much easier for GDOT to deal with because so much of the learning and technical expertise they had acquired dealing with Indiana Bats was transferable to this new species.

We ran a second OLS model, also included in Table 3, to measure the impact of the second *adaptive event* (Gray Bats) and gauge the *adaptive performance* of GDOT by comparing it to the first *adaptive event* (Indiana Bats). The coefficient for the second event's interruption is positive, showing that this set of interrupted projects was delayed by about 226 days, but it is not statistically significant. This supports the narrative originating from our qualitative analysis because it shows that the second shock was much less disruptive than its precursor. The resulting delay was much smaller than that of the first shock and was statistically insignificant meaning that we cannot be confident that the second shock disrupted project timelines at all. GDOT was able to minimize the disruption of the second *adaptive event* it experienced due to learning it gained through AM.

As shown by staff interviews, GDOT engaged in another phase of *goal determination* through discussion with regulators and consultants about Gray Bats, but they were able to quickly arrive at a conclusion by applying their previous learning to the new case. Additionally, many of the consultants responsible for surveying for this new species already had the skills and certifications in place to deal with bats under the ESA resulting in fewer delays. GDOT had a much easier learning curve during this second *adaptive event* because the iterations of procedural refinement it had already gone through for the Indiana Bat served as preparation.

3.4.3. Generating Learning through Adaptive Management

Although not yet protected by ESA regulations, GDOT then began paying more attention to other native bats listed as threatened or species of concern. Finding new bats, in tandem with the incursion of WNS into Georgia, put GDOT on alert for local species. This ushered in yet another *adaptive event* related to bats for GDOT to deal with.

In January of 2013 the USFWS published a set of procedures for dealing with Indiana Bats across their entire US range. GDOT now had to factor this additional set of guidelines in on their projects. These procedures were set at the federal level and not open to change. However, GDOT continued learning about bats and tweaking its own procedures (within the overall structure of the federal guidelines) well past the date the national guidelines were instituted. At GDOT, consultants continued to monitor Georgian bats, and the procedures used to deal with them, providing feedback to GDOT on a project by project basis. GDOT, in turn, continued to improve its bat-related procedures in an iterative fashion. This continued until the end of the time period we observe in 2015 when GDOT published a new template triggering data collection on bats anytime a bridge was present on one of its project sites. Even after universal federal regulations were put in place, GDOT continued adapting to bats within its own state context, refining its procedures as necessary through *iterative management*.

GDOT was able to learn how to meet the standards of newly implemented federal regulations more effectively by implementing an initial strategy and revising it over time in response to feedback from its consultants. This strategy also enabled it to efficiently apply previous techniques to other threatened bat species. Continued field monitoring by consultants enabled GDOT to assess and refine its management decisions. The contracting

structure of the agency-consultant relationship did not dictate independent monitoring of bats, but the normal job activities they conducted (e.g. ecological studies and field surveys) necessitated the continued monitoring of at-risk counties within the agency's jurisdiction. This situation presented an opportunity to observe AM. GDOT's use of historical data, hypothesis forming, and iterative learning to assess its projects show reliance on consultants to facilitate knowledge generation, but that it still engaged in an adaptive process, unlike traditional bureaucratic procedures. The more experience GDOT acquired with bats and time it had available to adapt, the more expediently it was able to fulfill the expectations of the new regulations and complete its environmental reviews. Over time GDOT minimized the shock of the regulatory change by cooperatively learning and refining the management methods it employed.

3.5. Discussion

GDOT acted as AM predicts, but it did so in a slightly different way than we expected. It engaged in three-tiered collaboration within a largely authoritarian structure. Even though the consultants are subordinate to GDOT, and GDOT is subordinate to the environmental regulatory agencies, they all collaborated together in order to successfully adapt to the introduction of bats. Consultants at GDOT fulfill three different roles. First, they serve as GDOT agents, satisfying their direct contractual obligations. Second, they act as environmental specialists who generate learning through their experience at the project level. Finally, they act as intermediaries between GDOT and other public agencies, federal regulators, research and environmental groups, and local stakeholders. GDOT is not a collaboratively governed organization. It maintains a principle-agent relationship with its

consultants and retains the hierarchical structure of most traditional bureaucracies. However, it exercises discretion in how it applies this hierarchy within the decision-making process, incorporating elements of collaborative governance in order to facilitate adaptive learning. GDOT's consultants broker communication between GDOT and other public and private stakeholders, giving them a say in how environmental issues are addressed. GDOT maintains enough lateral flexibility within a vertically structured government system to manage environmental subjects using AM.

As AM suggests, there was internal discussion within GDOT; there were also simultaneous channels of top-down and bottom-up communication. Federal regulatory agencies mandated requirements for GDOT, but they also allowed feedback from GDOT to inform them about what practices were best suited to fulfill their requirements. GDOT acted the same way with its consultants. It mandated procedures but relied on consultants' input to help revise them. In addition, consultants regularly engaged in discussion with the environmental regulatory agencies themselves. They were not limited to communicating with GDOT. They often went to the source and discussed the regulations they were required to follow directly with the regulatory agencies. The consulting community itself engaged in market adaptation, leading to a complex network of relationships between consulting firms regarding the regulatory issue. Some firms chose to specialize in the new changes, immersing themselves as experts and mediators in GDOT's adaptive process, while others chose to defer, subcontracting out related work to firms which had already gained specialization. We do not see strict internal discussion or adherence to the principle-agent hierarchy between the federal regulatory agencies, GDOT, and consultants, or uniform action being taken by all consultants. Instead, we see multi-tiered collaboration

where what must be done is dictated in a top-down structure, but how it should be done is informed through a bottom-up approach. This is enabled by GDOT consultants who opted to immerse themselves in the adaptive process to act as mediating agents by bridging communication between GDOT and regulatory agencies. They provided the horizontal flexibility necessary to successfully adapt to the bat-induced regulatory shock within a vertically aligned system. This structure is modelled in Figure 5.

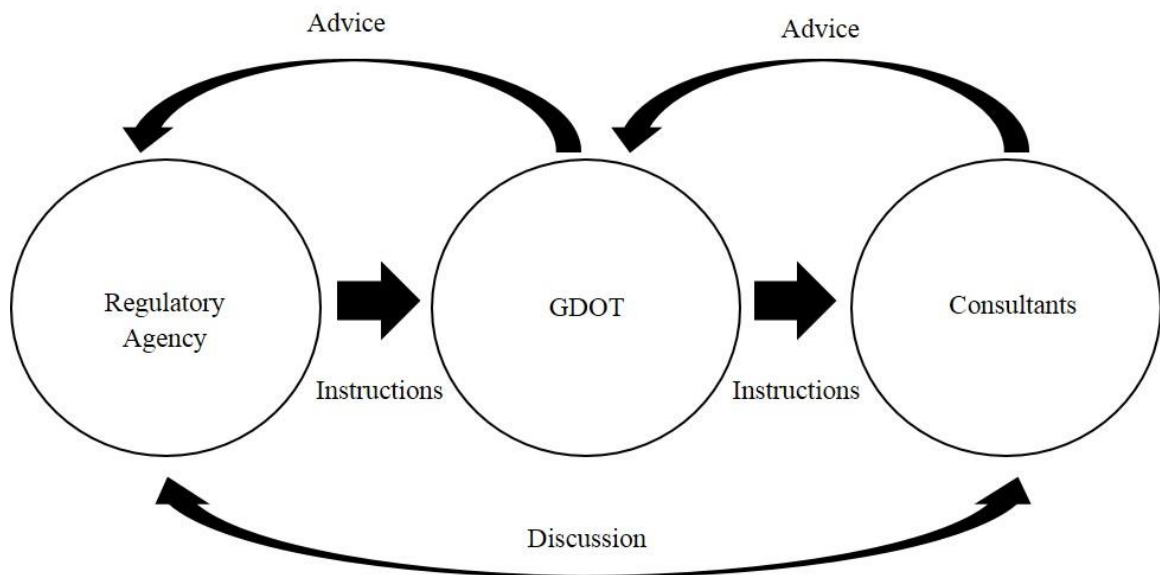


Figure 5: Multi-Tiered Collaboration

Collaborative architecture at GDOT

The multi-tiered collaboration structure enabled GDOT to engage in AM. GDOT itself remained passive, choosing not to set aside a portfolio of projects to experiment on explicitly. However, it was able to learn about bats through collaboration with consultants who were gathering knowledge through iterative interactions, and natural experimentation,

with bats at the project level. This coordination allows GDOT to learn about complex environmental problems and successfully adapt to the changing environment over time.

The relationships between managers and consultants are not well explained in the AM literature. These relationships are often present in environmental management situations, but they are not explicitly described in AM models. How they fit into the adaptive process needs to be addressed in order to better our understanding of how AM can function within a bureaucratic system. When NPM and collaborative practices lead a bureaucracy to engage with private consultants, it can have the flexibility necessary to collaborate with multiple actors and generate knowledge through AM. This can allow organizations to achieve better management outcomes within the context of a top-down, authoritarian system. We build off the existing AM model (Figure 2) by incorporating the multi-tiered collaboration system we observe in our analysis into the process. See Figure 6.

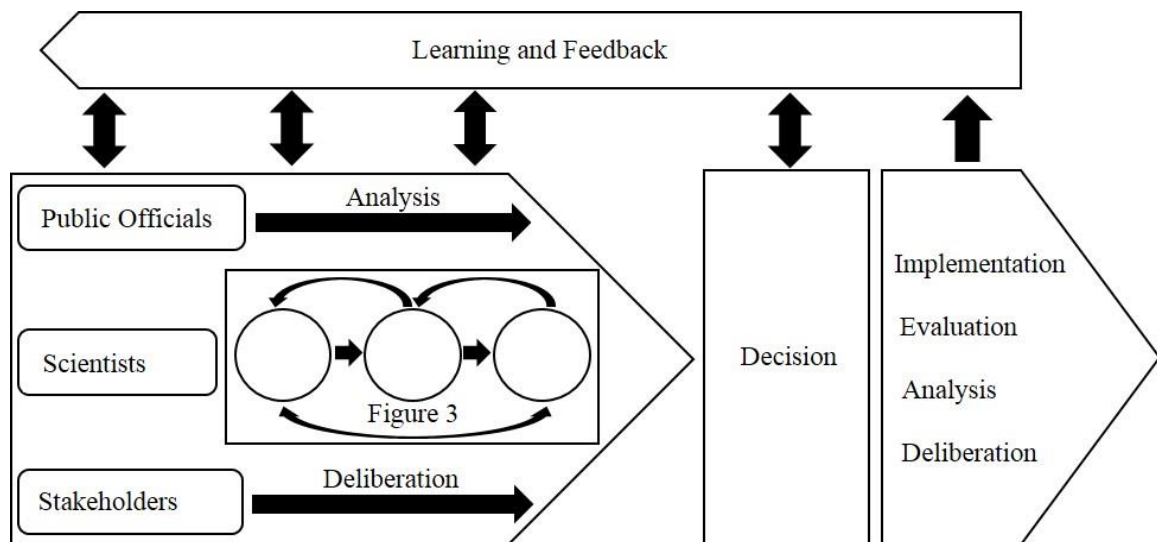


Figure 6: Improved Adaptive Management Model

AM model including a multi-tiered collaboration system

This understanding may encourage the use of AM in bureaucratic organizations through outsourcing. Institutions which do not traditionally employ adaptive strategies might try to capture the benefits adaptation provides through the third-party actors they outsource to. Today, conservation decisions are often based on experience rather than real evidence, undermining practitioners' ability to make effective conservation decisions (Pullin & Knight, 2001). Sutherland et al. (2004) stress that the need for evidence-based conservation is critical; structures which incorporate systematic monitoring and review into the decision-making process are crucial for environmental managers to make effective choices. The adaptive structure we observe at GDOT is one way for evidence-based decision-making to be integrated into the management process within a bureaucratic organization.

3.6. Conclusions

We observe adaptive practices occurring at two levels. First, we find that when GDOT encountered environmental shocks it shifted towards a more adaptive approach, relying on consultants to gather information from individual infrastructure projects in a manner that resembles iterative experimentation. GDOT's goals were to learn about environmental conditions as well as to develop new standardized procedures and guidance that could be applied to future projects. In the face of shocks, GDOT moved to an adaptive posture and then sought to establish new standard operating procedures (i.e. bureaucratic processes) once the shocks were absorbed. Environmental consultants provided important information from the field that facilitated this learning process. We also identify a second adaptive process that spans both periods of shock and periods of normal operations. GDOT

relied on consultants as a matter of routine to facilitate adaptive changes in management strategy over time.

GDOT's organizational structure allows it to engage in multi-tiered collaboration, knowledge generation, and adaptation through AM. The more time GDOT had available to learn and adapt to the regulatory shock, the more successfully it was able to manage the environmental review of its projects. Environmental review durations significantly decrease the more time is available to GDOT for adaptation even after controlling for project type, NEPA classification, funding source, and staff experience.

However, there are several limitations to this study. Our results are constrained due to a limitation in the nature of our dataset. Projects do not enter our dataset until they are completed so there is a sampling bias present at the end of the time window our dataset represents. While complex projects requiring long periods of time to complete are included in our dataset if they began very early (their having been completed within the data collection window), projects which were in progress, but were not yet completed before the end of the data collection window are absent. This means that the subset of projects in our dataset which started late in the data collection window will likely have a higher proportion of projects with short durations than the rest of the dataset. Many complex projects requiring longer durations were ongoing at the time, but if they didn't finish before the data were compiled they were not included. This potentially biases our results. However, the story our results illustrate is generally compliant with our qualitative analysis.

Second, due to the construction of our dataset, as noted above, and the quick succession of the first and second *adaptive events*, there is substantial overlap between the

shocks for Indiana and Gray Bats. Many of the interrupted projects we observe were impacted by both events. Out of the 11 projects interrupted by Indiana Bats, nine were also interrupted by the subsequent Gray Bat shock. There are only two and one total projects uniquely interrupted by the Indiana and Gray Bat shocks respectively. The addition of the Gray Bat shock could have contributed to additional time disruption for projects already shocked by the Indiana Bat event. Performance data indicates that this may not be the case as environmental review durations were not longer for projects interrupted by both *adaptive events* than for those uniquely interrupted by the first event, but this remains an area of concern.

Future research on this subject using a more complete set of performance data across mutually exclusive *adaptive events* would be useful to help clarify these issues. More robust statistical tests are needed to estimate the impact of the adaptation organizations like GDOT engage in. Furthermore, additional research using Bayesian methods may enrich our results. Bayesian network models provide a statistically sound framework to integrate qualitative and quantitative information from diverse sources, and explicitly model uncertainty (Barton et al., 2006; McCann, Marcot, & Ellis, 2006; Peal, 1988), making them extremely relevant to this type of research question. Future research using this approach could account for uncertainty and other interactive effects which would help increase our understanding of how feedback routes function in the adaptive process.

This study points to AM as an effective method of internalizing environmental shocks under uncertainty, stabilizing the situation around them and allowing a return to normal operations where projects can be completed in a similar amount of time to how long they took before the shocks occurred. In addition, it indicates that multi-partner

collaboration can be a successful strategy for integrating dynamic learning into the management process. The multi-level communication structure implemented by GDOT is a strong format for applying AM. We build on existing models to explain how multiple partners and mediating actors collaborate in order to successfully achieve AM goals.

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CHAPTER 4

IT'S TURTLES ALL THE WAY DOWN: THE PROS AND CONS OF STAKEHOLDER ENTHUSIASM IN COLLABORATIVE SEA TURTLE MANAGEMENT

Evan M. Mistur

4.1. Introduction

Stakeholder engagement is an increasingly popular policy prescription for managing environmental subjects. Complex environmental issues often demand flexible decision-making and diverse knowledge inputs to successfully navigate (Reed, 2008). Consequently, many organizations integrate local stakeholders into the management process as a way to broaden their decision-making inputs and increase the success of implementation. This tool has been adopted by numerous management agencies and has been applied from local to international levels (Chase et al., 2002; Stringer et al., 2007).

Engaging stakeholders has received widespread acceptance and is predominantly accepted as appropriate due to its normative appeal (Arnstein, 1969), but there remains a lack of definition about when it is actually a useful tool. Claims that it improves management outcomes have rarely been tested and are criticized by practitioners who have not seen its benefits realized (Reed, 2008). There is substantial room for growth in developing our understanding of how stakeholder engagement impacts the focus, motivations, and actions of environmental managers. Identifying and analyzing these factors is critical for making appropriate decisions in environmental management.

In this analysis, I examine the Georgia Sea Turtle Cooperative, a case of long-term coordination between local stakeholders and the Georgia Department of Natural Resources (GDNR). This group engages stakeholders in the implementation of GDNR conservation efforts to ensure the conservation of sea turtles in Georgia. I study this case to investigate the impacts stakeholder engagement can have on management by affecting managers' ability to effectively accomplish their work, their motivations for action and potential to create goal misalignment in the organization, and the types of actions they pursue. Importantly, this research can help reveal whether engagement can help increase the management capacity of organizations and whether it can lead to target fixation (the misplacement of agency resources due to goal misalignment) among managers.

4.2. Stakeholder Engagement

Stakeholder engagement can take a wide variety of forms, offering different ways to incorporate collaboration into management. This strategy is designed to incorporate public actors into the management process and has been heralded as an advantageous alternative to traditional, hierarchical systems where a single actor or group commands exclusive influence over the system (Keough & Blahna, 2006). Incorporating collaborative elements into environmental governance is common practice in numerous management settings around the world (Ansell & Gash, 2008; Emerson & Nabatchi, 2015; McGuire, 2006; Newig & Fritsch, 2009). However, despite its appeal and common usage, there is little consensus about what engaging stakeholders means (Reinegal, 2013).

Engaging relevant stakeholders provides an avenue for collaborative elements to take place across diverse scales of environmental management and can operate at various

levels of intensity. Stakeholders are most commonly defined (Stieb, 2009) as actors who impact, or are impacted by, a decision (Freeman, 1984). They can be said to engage with an issue if they choose to actively involve themselves with it (Rowe et al., 2004). While collaboration requires this to happen at the decision-making level, stakeholders can engage in management more broadly in a number of different forms. Numerous interpretations of what engagement entails have arisen (Lawrence, 2006), creating the need for a typology to organize different definitions and indicate when each is most appropriate to use (Reed, 2008).

One of the first of these typologies describes how engagement can take place along a spectrum of different participatory actions, allowing stakeholders to participate in anything from active decision-making to passive information dissemination (Arnstein, 1969). This *ladder of participation* has since been refined, and can be concisely split into three levels of engagement: *consultative* (stakeholders passively contribute information), *functional* (stakeholders enhance implementation through labor, resources, and knowledge), and *empowering* (stakeholders collaborate in decision-making) (Farrington, 1998). This typology dictates that higher levels of engagement (i.e. collaboration) are better and are preferable to those in lower positions on the ladder, but this may not always be the case. The impact of different types of engagement is dependent on the management context and capacity of stakeholders (Richards et al., 2004), so different levels of engagement will be appropriate in different situations (Reed, 2008).

4.2.1. Benefits of Collaboration

Regardless of the type, or orientation, of engagement, it can benefit efforts to manage ecological systems which span boundaries across space and time. Including stakeholders in management can improve decision-making and outcomes (Beierle, 2002; Fischer, 2000; Reed et al., 2008). At the empowering level, discourse and inclusivity make it possible to evaluate decisions more pluralistically and situationally, making them key attributes for dealing with boundary and value-spanning issues (Norton, 2005; 2015). This helps contribute local knowledge and expertise when developing rules (Andersson & Ostrom, 2008) and foster social learning (Leach et al., 2013; Lejano & Ingram, 2009) enhancing stakeholders' awareness and capabilities when dealing with local issues.

Engagement brings many advantages for policy implementation as well. There is substantial evidence indicating that it benefits many intermediate outcomes associated with social components of environmental management. Engagement between managers and stakeholders helps build trust and local commitment to management decisions (Armitage et al., 2009; Olsson et al., 2004; Reed, 2008; Richards et al., 2004). It also improves the legitimacy of outcomes in the public eye (Sabatier et al., 2005) and can foster belief change in the stakeholder community (Leach et al., 2013), getting individuals to buy into management goals and improving the prospects of successful implementation (Richards et al., 2004). Engagement also creates the opportunity for co-generation of knowledge between managers and stakeholders (Greenwood et al., 1993; Wallerstein, 1999), and facilitates social learning (Blackstock et al., 2007; Leach et al., 2013; Lejano & Ingram, 2009), creating positive externalities to the management process.

At the functional level of participation, engagement offers substantial benefits. It can integrate local knowledge into management efforts (Andersson & Ostrom, 2008) and contribute additional resources and localized support to implementation efforts (Hill & Lynn, 2013). This enables managers to more successfully satisfy local needs (Andersson & Ostrom, 2008) and can help managers deal with unanticipated problems more easily (Fischer, 2000; Newig, 2007). Incorporating stakeholder engagement can provide a host of benefits and result in more appropriate environmental management in the long run (Bierele, 2002; Brody, 2003).

4.2.2. Potential Drawbacks

However, many researchers have pointed out potential problems and pitfalls for stakeholder engagement. At the empowering level, bringing stakeholders into the process can subvert appropriate management decisions. Participation of inexperienced or ill-informed stakeholders can result in sub-par decisions when the opinions of experts are overridden, or economically interested parties dominate the discussion (Echiverria, 2001). Collaborative groups are also prone to favoring less stringent policies or trying to appease all their members with ineffectual “win-win” solutions that address numerous objectives and achieve none (Layzer, 2008). At the functional level, organizing and engaging in collaboration can be costly and time-consuming (Margerum, 2011). It can take considerable resources to maintain a suitable arena for coordinating all relevant stakeholders and overcome the transaction costs associated with such engagement. If these costs are high enough there may be no perceived benefits to investing in them from a management perspective (King & Ehlert, 2008). Engagement may also demand onerous

commitments from the participating stakeholders themselves, discouraging involvement (Lawrence & Deagen, 2001).

Furthermore, inviting actors who have different motivations or missions to participate can create goal misalignment, leading to tension and conflict in the management process (Fleming et al., 2015). While conflicts are not inherently bad, they can lead to divergent subunit goals (Meier, 1997; Pondy, 1966) and irrational decision-making (Buntz & Radin, 1983; Schmidt & Kotchen, 1972; Selbst, 1978) resulting in counterproductive management outcomes. Exposure to alternative motivations or goals through engagement may create issues for mission-oriented management organizations. These potential disadvantages can be difficult to overcome, so engaging stakeholders is not well suited to every situation.

4.2.3. Engagement in Organizations

Institutional perspectives have become popular in organizational theory (Mizruchi & Fein, 1999) and provide language and constructs which are highly relevant with collaboration and stakeholder engagement. Institutional models of how organizations function emphasize the impact exogenous social factors can have on organizational behavior (Heugens, 2009). In this perspective, organizations' decision-making processes are developed and influenced by the socially constructed environment around them. Social and management context drives how organizations make decisions and act.

Organizations are affected by situational constructs and normative pressure placed on them by social forces (Zucker, 1987). The institutional environment in which an

organization exists determines what impacts them. Hierarchically superior forces, such as laws, regulations, or market forces, have a strong influence on organizational decision-making (Thomas & Meyer, 1984), but for public agencies, public opinion can be a driver as well. Societal demands and influences can lead to the formation of “institutional elements”. These elements can take the form of organizational structures, roles, or actions, and once in place, often become embedded in the organization, resisting change as the status quo (Zucker 1977). These elements can heavily sway an organization’s’ decisions, potentially subverting its management goals (Selznick, 1949; Zald & Denton, 1963).

Public voice and activity can be a major part of the institutional environmental landscape for public agencies. When public actors engage with a topic, they exert pressure on management organizations to meet their demands or desires. Direct collaboration or stakeholder engagement can further reinforce these impacts. Collaboration can directly influence the production of outputs such as plans for environmental managers as stakeholders engage in the decision-making process (Beierle, 2002; Biddle & Koontz, 2014; Innes & Booher, 1999), but other types of engagement can influence organizations as well, as participation places added attention on stakeholders’ individual goals. If engagement generates additional organizational attention on a subject, managers may devote more attention to that subject. Similarly, if an organization engages with stakeholders who do not share its overall mission, goal misalignment may grow.

4.2.4. Managerial Motivations

Individuals' motivations drive their willingness to engage in a management area as well as the types of actions they are likely to focus on when doing so. While managers within an agency are likely to be motivated by the goals of their organization, the institutional elements shaped by the organizations' surrounding environment (e.g. the goals of engaged stakeholders) may be transmitted and internalized by organizational agents (Zucker, 1987). As the institutional environment around their organization shifts, exerting different pressures on it and reshaping its goals, managers may adopt new motivations, or reprioritize which ones they see as important. Since collaboration and stakeholder engagement can drive institutional environmental structure, increased collaboration may alter the internal motivations of managers in an organization, creating misalignment between individual and organizational goals.

Additionally, environmental managers working in an organization may carry their own personal motivations on top of, or contrary to, those formally specified by their organization. These personal motivations may persist, influencing the way managers approach and interpret organizational goals. While at the empowering level of participation, collaboration is intended to shift organizational goals, engagement at other levels is not always meant to do so. In management situations that demand high levels of technical knowledge and expertise, engagement at the functional or consultative levels may be more appropriate. In those situations, goal misalignment might be counterproductive and undermine management outcomes.

4.2.5. Target Fixation

If engaging with stakeholders influences managers' motivations in an organizational setting, then it may have additional implications for their actions. Humans have a limited capacity to take in and process information, and those limitations extend to the organizations they serve (March & Simon, 1958). Individual actors are boundedly rational, having access to a finite, and small, amount of computational power and are only able to handle a limited cognitive load (Simon, 1957). On their own, they can only process information serially, biasing their ability to search for and select different management options. Organizations are able to get around some of these limitations by dividing up labor to address multiple issues in parallel (Jones, 2001), but this can only extend processing power so far. Organizational agents commonly practice satisficing when making choices, accessing information that is easily available and implementing decisions which require the least effort to acquire the desired result (Simon, 1972). When faced with complex situations, individuals tend to make simplifying assumptions to substitute them with simple systems which they understand and are comfortable making decisions about (March & Simon, 1958).

These limitations subject individuals to *target fixation*, focusing all of their processing power on a single subject to the neglect of others. What someone pays attention to is driven by what they want and value; at the same time, what they value is influenced by what their attention is focused on (March & Simon, 1958). When an organization engages with stakeholders on a specific subject, it may shift the focus of managers within that organization onto socially prioritized subjects. This may create goal misalignment between individual managers and the organization. Individuals' focus may

lead them to overemphasize a single subject as managers continually have its importance reinforced on them by exogenous social forces and their own cognitive biases. Such a situation may represent a positive reinforcement, but it has the potential to create *target fixation* if this focus represents an overemphasis and comes at the expense of other subjects that organization is responsible for.

Furthermore, individuals who carry their own set of personal motivations are at risk of fixating on their own personal priorities rather than fulfilling organizational guidelines as they were intended. These personal, alternative, motivations may alter how an individual manager perceives goals, interprets guidelines, and implements managerial actions, changing organizational outcomes. While this can benefit management in some situations, when it is more appropriate for an organization to engage stakeholders at the consultative or functional levels without creating participation at higher levels of collaboration, it may create goal misalignment and undermine management outcomes.

4.3. Research Context

Of the seven recognized of sea turtle species, three are endangered or critically endangered, and the rest are vulnerable (IUCN, 2018). Anthropogenic impacts from fisheries (Lewison et al., 2004), beach degradation, pollution, and capture (Lutcavage et al., 2017) are responsible for huge amounts of turtle destruction, intensifying their vulnerability. Global populations have been rapidly declining, leaving these species at risk. Five sea turtle species are present in the state of Georgia, with three nesting on Georgian beaches (GDNR, 2018a). Table 4 depicts the status of each sea turtle species as well as their presence in Georgia.

Table 4: Sea Turtle Species in Georgia

Common Name	Scientific Name	Risk Level (IUCN, 2018)	Presence in Georgia
Flatback	<i>Natator depresa</i>	Data Deficient	Not present
Green Turtle	<i>Chelonia mydas</i>	Endangered	Occasionally Nests
Hawksbill	<i>Eretmochelys imbricata</i>	Critically Endangered	Frequents Waters
Kemp's Ridley	<i>Lepidochelys kempii</i>	Critically Endangered	Frequents Waters
Leatherback	<i>Dermochelys coriacea</i>	Vulnerable	Occasionally Nests
Loggerhead	<i>Caretta caretta</i>	Vulnerable	Commonly Nests
Olive Ridley	<i>Lepidochelys olivacea</i>	Vulnerable	Not Present

These turtles inhabit the waters along the Georgian coast and utilize a string of barrier islands it contains to nest. These islands provide important nesting habitat for sea turtles and are critical for the stability of Loggerhead Turtle populations. They provide many crucial ecoservices for inland areas of the state as well, such as surge protection and shelter from oceanic storms, structure for coastal and wetland habitats, and ecosystems for native species (Feagin et al., 2010). However, these islands are particularly vulnerable to climate change (Martinez et al., 2008), and are popular destinations for human visitors, putting them at risk from anthropogenic degradation. Consequently, they are a continual subject of concern for environmental managers and researchers in Georgia, particularly in GDNR.

4.3.1. The Georgia Sea Turtle Cooperative

GDNR is a state agency responsible for overseeing and managing natural, historic, and cultural resources within the state of Georgia (GDNR, 2018b). Within this

organization, the Coastal Resources Division (CRD) is tasked with managing the wetlands, fishery resources, and beaches along the coast, making it responsible for conservation of important nesting habitat on the barrier islands. Along with GDNR's Wildlife Resources Division, it runs coast-wide programs aimed at conservation. In this research, I focus on the case of one specific GDNR program, the Georgia Sea Turtle Cooperative, since it provides a unique look into collaborative management in an organizational setting.

The Georgia Sea Turtle Cooperative, or the Coop, is designed to organize local stakeholders, organizations, and agencies together with GDNR to manage Georgia sea turtle populations. It has existed for over 50 years bringing environmental managers, researchers, environmental agencies, private foundations, non-governmental organizations (NGOs), and local stakeholders together to engage in turtle conservation. About 200 volunteers are enlisted in the program each year during the sea turtle nesting season from mid-May to mid-August (GDNR, 2019). This allows local stakeholders to contribute to GDNR turtle management at the functional level. Sea turtle management requires high level knowledge and ecological experience so GDNR chooses to maintain decision-making power in-house. In general, the Coop is collaborative in implementation but not in decision-making. GDNR leaders decide what should be done and then engage with local stakeholders to implement it. Volunteers are primarily used to provide manpower to monitor nesting turtles, maintain turtle nesting sites, deter local predators, collect data, and implement other programmatic tasks as necessary.

However, some volunteers are also employed as project leaders in the Coop, offering a unique look into how stakeholder engagement can effect organization

decisions and management implementation. The Coop is directed by a GDNR wildlife biologist, but it relies on 12 different project leaders to manage Coop operations on Georgia's 12 main barrier islands for turtle nesting. These project leaders come from a wide variety of backgrounds; some are volunteers with little environmental experience outside of the Coop while others are scientists working for environmental non-profits, private management foundations, federal agencies, or GDNR itself. GDNR outlines explicit requirements for turtle management on each island and outlines what efforts and interventions should take place, but project leaders maintain some flexibility when applying them. While certain aspects of the management plan, such as data collection, are highly standardized and remain the same between islands, different project leaders can apply turtle management differently. This offers critical variance to explore different the relationships between project leaders' motivations and actions.

This coop is perceived by GDNR staff as being highly successful, both as a management tool and a social education program and is an important part of GDNR's sea turtle conservation program. It provides important benefits for turtle conservation in the form of data collection, predation control, and nest management, as well as numerous other tasks associated with beach conservation, and is widely perceived as critical for turtle conservation among GDNR staff and stakeholders who are involved.

4.4. Research Questions & Hypotheses

This program offers an excellent opportunity to study the impacts of stakeholder engagement on environmental management. It provides a useful context to examine the different ways engagement can contribute to management decision-making and outcomes

at the functional level. Furthermore, it presents an ideal space to study the motivations and attitudes of different managers and investigate how those attitudes influence the management actions that are implemented.

In this analysis, I pursue these topics in three ways. First, I examine the role of stakeholder engagement through the Georgia Sea Turtle Coop in GDNR turtle conservation and describe the perceived contributions it provides the organization.

Hypothesis 1: Stakeholder engagement increases the environmental management capacity.

Second, I explore the motivations of environmental managers and volunteer stakeholders in the program to understand the level of goal alignment in the organization. Stakeholders may have different motivations and goals than the organization and may create goal misalignment in the agency.

Hypothesis 2: Stakeholders will have different motivations and pursue different goals than the agency they engage with, creating goal misalignment.

Third, I examine whether goal misalignment causes target fixation, analyzing how managers' motivations influence their actions outside of the goals set by the organization. If managers are driven by goals that are not shared by the organization they may act contrary to, or outside of, the mission pursued by the organization.

Hypothesis 3: Increased influence from engaged stakeholders will increase the likelihood of target fixation.

4.5. Materials & Methods

I employ a mix of qualitative data in a case study research design to investigate these questions. I develop interviews and a questionnaire to explore the perspectives of various members of the Sea Turtle Coop. I conducted seven semi-structured interviews between February and March of 2019 with the program director and project leaders from a variety of backgrounds in the Sea Turtle Coop. Table 5 illustrates the involvement and position of each respondent.

Table 5: Respondent Categories

Number	Involvement	Position
1	Project Leader	Volunteer
2	Project Leader	Volunteer
3	Project Leader	Volunteer
4	Project Leader	Environmental manager at a private organization
5	Project Leader	Environmental manager at a non-profit organization
6	Project Leader	Environmental manager at a public organization
7	Program Director	Environmental manager at a public organization

These data reveal the perspectives of the actors involved and provide evidence on each hypothesis. Respondent perspectives provide an in-depth assessment of the programs' management capacity and success from those who are most familiar with it and most qualified to speak about its impact on Georgia sea turtle management. Additionally, they reveal respondent' motivations and goals both directly (through direct inquiry) and indirectly (through the subject matter of responses). Second, I administered a questionnaire to members of the Sea Turtle Coop on April 23, 2019 to explore the experience, motivations, and goals of engaged stakeholders across the program. This questionnaire was responded to by 26 members of the Sea Turtle Coop at the volunteer

and project leader level and includes data on the motivations of volunteers, associates, and project leaders and allows me to triangulate my findings with evidence from the interview data. Together, these data allow me to construct a robust qualitative analysis of this case study and test my hypotheses on goal alignment and target fixation.

4.6. Results

4.6.1. Management Capacity

Interview data clearly illustrate the benefits stakeholder engagement in the Sea Turtle Coop confers to GDNR's ability to implement environmental management. Respondents universally agree that engaging stakeholders allows more successful management of sea turtles in Georgia. These benefits are most evident at the functional level, providing critical manpower that is needed by GDNR to operate its interventions in turtle management. GDNR lacks the staff to consistently run all of their turtle management efforts in-house, so they rely on local stakeholders to help collect data and manage turtle nest sites.

“You just don't have the staff [...] especially from a state and federal standpoint if you're dealing with beaches that are managed from the state or federal agencies. They don't have staff on hand that could commit the time every day for six months of the season every season to do that kind of work. So those technicians and interns and volunteers are really key to continuing on at the level we're doing it statewide.” (Volunteer Perspective)

While the manpower volunteers contribute is important, project leaders in the Sea Turtle Coop who come from an environmental management background understand that engaging stakeholders can be costly. Organizing volunteers and training them to effectively contribute to a subject's management takes time, energy, and supervision

from full-time environmental managers. For some projects, volunteers are not worth bringing on at all.

“There's a basic cost from the outset for any of these volunteer projects. And you just can't cut people loose on their own. There has to be some supervision. And so for some of the smaller projects, it's just not worth the startup cost. Whereas with the really big-scale projects over a large area where we need a lot of manpower, it's worth the startup cost of our time and energy overseeing the whole thing.”
(Environmental Manager Perspective)

However, even with the added costs engaging stakeholders entails, volunteerism in the Sea Turtle Coop is perceived as creating substantial benefits. While training and supervision are necessary, these costs are perceived as being well worth it for the consistent contributions engaging volunteers brings.

“I think they're a huge help if you get the right ones, let's put it that way [...] everybody loves sea turtles but you've got to get the people that love sea turtles that are also good at field biology and data collection. If you're going to have a program where you're going to utilize them to an extent where they're helping you to the maximum level possible, you've got to have somebody that you feel comfortable with.” (Environmental Manager Perspective)

Volunteers are necessary in order to consistently collect data, conduct daily surveys for turtles on beaches, protect local nests, and perform other essential program tasks. Project leaders in the Sea Turtle Coop from all backgrounds agree that the program would not be possible without the substantial help they receive from local stakeholders.

“These people are really the heart of our conservation efforts. They do the basic [...] grunt work of conservation.” (Environmental Manager Perspective)

“Without them, we wouldn't get anything done, really. We wouldn't be educating. We wouldn't [be doing daily turtle monitoring] on the beach besides just the baseline state-required morning patrol. And as far as turtle rehab and everything – all the work wouldn't be possible without them.” (Volunteer Perspective)

Engaging stakeholders also benefits GDNR functionally. Increasing social awareness about turtle conservation is not the main goal of the Sea Turtle Coop, but it is deliberately pursued by GDNR, and it is greatly facilitated by stakeholder engagement. Both volunteer and environmental manager project leaders see this as an excellent tool to facilitate social learning and education, and intentionally use it for that purpose.

“As far as engaging volunteers in the public or our guests, or whoever, it's just we consider that part of our outreach. And it's a wonderful way to educate the local community and get more people excited about conservation in general. So just the more people that care about the species, the more apt they are to survive in the long term.” (Environmental Manager Perspective)

At the collaborative, or decision-making level, participation is perceived as having a more limited impact. GDNR maintains strict guidelines over what must be done when managing sea turtles. Respondents from both volunteer and environmental management backgrounds agree that volunteers are typically removed from the decision-making process. The deliberative goal-setting used in some collaboratives is absent from the Sea Turtle Coop so overall goals are solely driven by GDNR and the leaders within the Sea Turtle Coop. However, project leaders report that stakeholders who are engaged in the program do help develop new ideas about how to pursue organizational goals. While the program's goals are set by GDNR, volunteers regularly help come up with better ways to meet them.

“We welcome input and their feedback, and we've refined our protocols and our methods based on that input. I wouldn't say that they have changed our large-scale goals or mission or how we do the work, but they definitely helped us get quicker, safer, and clearer.” (Volunteer Perspective)

Project leaders with a background in management actually go further, describing how collaborators both help streamline existing procedures and develop new ideas about turtle management themselves.

[They contribute to] *“Both little things and big things. I mean, little things in terms of just better ways to do surveys or just better ways to tie stuff on your ATVs [...] but then also bigger things too [...] coming up with really important ideas about management and how we manage nests, what nests we relocate when – and they're interacting with our co-op members who see things. A lot of times, science is nothing more than seeing patterns and then quantifying those patterns; basic descriptive kind of science. And so a lot of our cooperators are really good at that.”* (Environmental Manager Perspective)

Collaboration is critical to management of sea turtles at GDNR. Engaging stakeholders through the Sea Turtle Coop generates substantial benefits at the functional and decision-making levels and allows GDNR to pursue and implement key management and research projects that would otherwise be impossible.

[Collaborators are] *“the backbone of our management. So they're like the engine that drives the whole thing, drives the train. So they're critical. We wouldn't be anywhere near where we are without-- and we're in a recovery period as a result of their activities.”* (Environmental Manager Perspective)

4.6.2. Motivations for Action

GDNR is responsible for managing all of Georgia's natural resources, not only sea turtles. As such, the goals espoused by the organization are expansive. GDNR scientists prioritize holistic thinking about ecosystems, working to save sea turtles not simply for their own sake, but in order to preserve the integrity and function of Georgia's marine ecosystems.

Conversely, many of the stakeholders who volunteer in the Sea Turtle Coop do so because they are passionate about sea turtle conservation. The interview respondents universally consider volunteers to be motivated, at least in part, by a personal attachment and care for sea turtles. Furthermore, volunteer responses to the questionnaire are highlighted by declarations of specific care and interest in sea turtle welfare. Over 83% of questionnaire respondents reported “saving at-risk turtles” as one of their primary interests, while answers to open-ended questions about why they collaborate include responses such as “*I get to spend time with sea turtles!*”, and “*I love sea turtles*”. Sea turtles are a highly charismatic group of species and have been popularized in social media in the past. One project leader even discussed seeing a rise in volunteerism in the Sea Turtle Coop after “The Last Song”, a film promoting sea turtles, was released. For many people, sea turtles demand affection and devotion, spurring individuals’ motivations to get involved in conservation.

“I think some of them just have a deep love for the coast and sea turtles. Some people are just really moved by handling eggs or handling hatchlings. It's like a life-changing experience for them, and you can see it when you've worked it a lot. And you have volunteers or interns that, the first time they ever handle a turtle egg or the first time they ever inventory a nest and see a live hatchling or the first time they see a female going up to nest, it really overwhelms them. And so those types of people, I believe that's why they continue to come back. They're people that they have that deep devotion to it.” (Environmental Manager Perspective)

Project leaders in the Sea Turtle Coop identify a few other motivations for involvement that appear among volunteers. Many people gain personal satisfaction from working and being in nature out on the beach, while others are driven by general environmentalism and concern for other subjects that occur alongside sea turtles.

“Most of them are pretty environmentally aware. And we talk about other environmental issues while we're on the project. Like we'll talk about the Right

Whales and pollution, and they see the garbage that washes up on the beach. Oh, there's all kinds of opportunities to talk about environmental issues.”
(Environmental Manager Perspective)

However, project leaders who come from both environmental management and volunteer backgrounds themselves report that engaged stakeholders are primarily driven by their attachment to sea turtles.

“They're all pretty out of their minds about sea turtles.” (Environmental Manager Perspective)

Project leaders in the Sea Turtle Coop have their own set of motivations for collaborating. Their motivations largely diverge between two groups: those that have a background in environmental science through higher education or career training and those that became involved as volunteers without scientific training. While project leaders who are trained in environmental science typically align with GDNR’s philosophy on management and express a motivation to prioritize holistic conservation of ecosystems rather than individual species, volunteer project leaders often share the same turtle-centric motivations as many of the stakeholders who they engage with.

“We really do have sort of two classes of cooperators. And one are sort of the professionals which are trained in biology, and you have a biological degree. Some of them have a master's degree and have done research. And then the second category with these, just someone, a member of the public who's just really interested in conservation and thinks turtles are cool and doesn't have any biological background.” (Environmental Manager Perspective)

Data from the questionnaire demonstrates that collaborators with a scientific or management-based background are more likely to prioritize system-level and holistic priorities and less likely to focus on individual subjects. Conversely, volunteers are more likely to prioritize individual-level subjects (e.g. specific concern for sea turtles, personal

benefits) and less likely to prioritize system-level subjects (e.g. general concern for threatened species) or holistic subjects (e.g. coastal resilience). While individual-level and turtle-centric motivations occur in both groups, they are more common among volunteers. Table 6 illustrates the average percentage of respondents from each group that identifies individual-level, system-level, and holistic subjects as priorities.⁶

Table 6: Average Percentage of Respondents Prioritizing Different Subjects

Group	n	Individual-level	System-level	Holistic
Scientists	11	54.7%	38.8%	66.4%
Volunteers	14	57.3%	34.5%	57.1%

When being interviewed, volunteer project leaders were not shy about their attachment to turtles. These respondents repeatedly discussed their emotional attachment to this specific group of species. This demonstrates a strong similarity between the motivations of volunteers in the Sea Turtle Coop and project leaders that came from a volunteer background. Both maintain alternative motivations in that they have different motivations for engaging in sea turtle management than GDNR.

“I’ve worked with other animals too, but there’s just something very, very charismatic and mysterious about turtles.” (Volunteer Perspective)

“What keeps me coming back to the co-op? Yeah. It really is the turtles. It’s the turtles. [...] I don’t think I would be there if there wasn’t nesting sea turtles. That’s

⁶ Individual-level subjects: saving at-risk turtles, helping animals, sea turtle populations, social experiences, enjoying nature, fellowship/community

System-level subjects: terrestrial reptiles, shorebirds, marine mammals, invertebrates, fish, plants, threatened species, socio-ecological systems, local fisheries, climate change, enabling science

Holistic subjects: healthy ecosystems, coastal resilience, sustainability, conservation science, ecological management, environmental research, evolutionary function

probably the big draw, but it's a whole package, right? It's that whole being able to live and work in that ecosystem. It's an unbelievable opportunity.” (Volunteer Perspective)

Some scientifically trained project leaders also mentioned a personal love of turtles, but they more frequently talked about conservation at a broad scale, in which sea turtles are one component. However, they repeated the observation that many of their peers who came from volunteer backgrounds are primarily motivated by their personal attachment to sea turtles. One respondent estimated that 25% of volunteers and local project leaders in the Sea Turtle Coop fail to understand environmental management holistically and are driven by an emotional attachment to turtles. As predicted in hypothesis 2, many stakeholders involved in the program have different motivations than GDNR. While having different motivations does not prevent them from pursuing the same objectives as the agency, it creates the potential for goal misalignment.

While the data strongly demonstrate that some project leaders in the Sea Turtle Coop share alternative interests with the volunteers they collaborate with, there is little evidence to indicate that they acquired these interests from their interactions with volunteers who thought this way. One volunteer project leader did note that being around collaborators who are passionate about a subject made them more aware, and interested in, that topic themselves. However, there is no compelling evidence that this altered their internal motives. Individuals’ core beliefs are very resistant to change (Sabatier & Weible, 2007). More often, the project leaders with emotional attachment to sea turtles talk about their motivations being driven by personal preferences and experiences.

“I'm a turtle person [...] I've always liked turtles. I've always cared for turtles. [...] As soon as I saw really the first egg, not even the actual turtle, I was instantly hooked.” (Volunteer Perspective)

“When I got my first sea turtle job, I really wanted to work in the marine mammal section, but there wasn't any opening. And I just thought, ‘Oh, I'll just work here till an opening comes up,’ and that lasted about two weeks. Once you work with sea turtles you're hooked.” (Environmental Manager Perspective)

This indicates that project leaders with this kind of motivation acquire them either before becoming involved, or soon after beginning their work with turtles. GDNR managers and scientists in the Sea Turtle Coop aim to train these volunteers, reinforcing holistic environmental thinking, but turtle-centric motives often persist. In the questionnaire data, experience in the Sea Turtle Coop does not appear to drive individuals' motivations. While stakeholders certainly learn while they are engaged in the program and interacting with trained environmental scientists, their motivations do not become more holistic or scientifically based over time. Collaborators at all levels of experience in the Sea Turtle Coop exhibit a mix of motivations, with emotional attachment to sea turtles appearing among groups of all age, experience, and tenure. Consistent with many other observations on individual's core beliefs (e.g. Lord et al., 1979; Munro & Ditto, 1997; Munro et al., 2002) turtle-centric motivations often persist despite exposure to scientific management and holistic organizational goals. Experience or tenure in the Sea Turtle Coop does not predict volunteer or project leaders' motives.

“We have people that've been working on Turtle Beach since before I was born for 50 years and who are still stuck in kind of the emotional-- yeah, can't really get to see the whole picture who still just care about turtles.” (Environmental Manager Perspective)

These turtle-centric motivations are critical in bringing volunteers to the table. The enthusiasm for these species encourages widespread volunteerism that is invaluable for GDNR's management capacity. However, they do not fully align with GDNR's holistic philosophy of conservation creating goal misalignment within the program. Volunteer

stakeholders engage in pursuit of slightly different goals than GDNR aims to achieve, creating the potential for issues to arise.

4.6.3. Target Fixation

Do these alternative motivations cause environmental managers to act outside of the agency's management plan? If a manager has their own internal set of motives that are misaligned with the goals of their organization, they may suffer from target fixation, focusing on the subjects they prioritize and working outside of, or even against, the management efforts prescribed by the organization. Do project leaders in the Sea Turtle Coop create issues for GDNR's overall management plan by focusing too much on saving individual sea turtles? This might occur in two ways. First, managers who are fixated on turtles might spend all of their time and energy intervening on the behalf of sea turtles, ignoring the conservation efforts needed by other environmental subjects in the area they manage or affecting them detrimentally. Second, a fixation on saving individual turtles might cause managers to implement different types of management interventions in the name of sea turtle conservation than are prescribed by GDNR.

Project leaders with a volunteer background, those who are more likely to have alternative motivations surrounding sea turtles, do not describe this as a problem at GDNR. Volunteer project leaders indicate that they strictly adhere to the organizational directions provided by GDNR on how to manage turtles, and that their management interventions take other subjects into account.

"We also share the beach with a number of species that aren't turtles, so we're working really closely with them to make sure that we can all have our eyes out

there for the same research and management goals and also for the same conservation goals.” (Volunteer Perspective)

“We do think about other species. However, we're out here because we're dealing with species protected on the Endangered Species Act, so they're our priorities, but we do try to minimize risk to other species. For example, when we're out on the beach at night, we're keeping an eye out for plovers. So, we're trying to reduce disturbance that way, but the sea turtles kind of drive the issue for us.” (Volunteer Perspective)

While they relate that turtle conservation is their primary focus, they do not perceive any project leaders' efforts as exclusive to that subject. From their perspective, all management interventions are driven by strict GDNR guidelines. However, this opinion is not shared by respondents with environmental science and management backgrounds. Several of the project leaders with environmental training in the Sea Turtle Coop contend that turtle-centric motivations influence the actions of volunteer project leaders. They describe some managers engaging in emotional decision-making then dealing with sea turtles and acting outside of the management goals set up by GDNR. Individuals' motivations influence their decision-making, and so can bias their actions. When goal misalignment creeps in, managers with goals that diverge from the organizations' priorities may act outside of the scheduled management plan.

“A lot of these people are doing this for emotional reasons, and so they make emotional decisions.” (Environmental Management Perspective)

This is not generally perceived to have negative impacts on other subjects in the Sea Turtle Coop. In this program, volunteer project leaders are tasked with managing sea turtles and nothing else. They are not responsible for dealing with other subjects so fixation on turtles does not divert them from other tasks. Furthermore, their activities are viewed as minimally invasive for other environmental subjects, so any negative

externalities they might create for other parts of the ecosystem while managing turtles are not considered serious. However, this kind of singled out focus creates the potential for issues to arise. Single-focused volunteers, or managers, can have substantial impacts on other subjects in the environment they are working in, and can create serious problem for subjects if they do not pay careful attention to them while on the beach dealing with turtles. While the volunteers in the Sea Turtle Coop is not perceived as creating these issues often, the potential for unintended abuse to other subjects is significant.

“They're out there doing the work, and they're the ones potentially having an influence on the other species. And so yeah, if they don't understand that, it wouldn't make a lot of sense to spend all the time and energy recovering loggerheads if we were removing some other part of the ecosystem. At the prop meetings, I always start the meeting by saying that the goal of the Endangered Species Act is not to just recover loggerheads or some other species that's listed. It's to recover the ecosystem upon which they depend. And the loggerheads are an indicated species, and they're telling us something. And so yeah, it wouldn't be consistent with the Endangered Species Act to be just saving loggerheads at all costs while other species were not doing as well. So, we try to make that point to them, but there's definitely some people in that room that you could say that all day long and it would never sink in.” (Environmental Manager Perspective)

Furthermore, from scientifically trained members' perspectives, this fixation on sea turtles can have substantial impacts on the management interventions individuals implement. Managers who are motivated to save individual turtles go overboard, spending an undue amount of time and resources on efforts to save individual sea turtles. When this occurs, it may divert the limited resources of the organization away from areas where they might be more effective.

“Each program is different depending on who's in charge of it and kind of what level of compassion they have for sea turtles. And so, you can see some management methods sometimes that you think are really over the top, and I think you can just relate that back to maybe one or two individuals that say, “Okay. We've got to do everything we can,” almost to the point that it's too much. [...] It's

not a management thing more so than just a personal preference.”
(Environmental Manager Perspective)

Pursuing misaligned goals also causes some project leaders, and the volunteers they organize to act outside of the directions outlined by GDNR scientists. This can get in the way of the organizations’ management initiatives.

“That attitude would lead them to be more focused on getting to a certain nest and trying to get the hatchlings out of it rather than completing a survey that they needed to complete and doing a full survey for the day or something like that.”
(Environmental Manager Perspective)

Not only can this disrupt agency management, but it can create long-term detriments for the sea turtles themselves. Acting outside of the organizational orders given to managers creates the potential for very serious environmental issues to arise in the long term.

A lot of our volunteers, as soon as that nest hatches, they want to dig in there and get all the babies in there that didn't get out, to get them out as quickly as possible. And so we say, "No, no, you got to wait. You got to let them come out on their own." And so, we wait five days, and that drives them insane. They'll get people that just can't stand it. And so, after the first day, they're like, "There might be some live babies in there. I don't care what DNR says. I'm digging in there and I'm getting them out." And so, they dig up the nest. And so, we find out about it and we say, "Look," we go through it again. "This is why we do it this way. And you could be actually hurting them by getting them out early. They need to emerge naturally and make their way down the beach. That may be when they imprint on their natal beach." (Environmental Manager Perspective)

Holistic environmental management can require actions that make little sense to volunteers who are motivated by saving individual sea turtles. Actions that save the lives of individuals are not always beneficial to the conservation of the species. For example, GDNR scientists are committed to recovering sea turtles as naturally as possible which sometimes requires turtle hatchlings which could be saved to be removed from the genetic population. In this management philosophy, hatchlings with genetic defects or

disease that are not fit to survive and reproduce should not be artificially saved through management. Doing so runs the risk of weakening the populations' genetic integrity. However, emotionally driven stakeholders often fail to see it in this way and refuse to abide by GDNR rules.

“To convince my emotionally driven volunteers to rebury the thing in the ground and let it die, I mean, they're not going to do that. They're attached to these animals, and they're going to release them no matter what. So those are the kind of decisions that they make.” (Environmental Manager Perspective)

Different management philosophies guide the actions environmental managers take. When goal misalignment appears within a management program it can undermine environmental outcomes. If an individual is motivated by an individual-level philosophy that prioritizes saving the life of single animals over broad environmental conservation goals, it can undermine a project. Emotionally driven managers and volunteers need not consciously work against organizational directives. Their personal philosophy and alternative motivations can cause them to interpret management directions differently than they were intended, biasing the actions they implement.

“People carry over this idea about – a lot of people, their conception of wildlife is that they're just animals like the pets they have at home, and that they need help, and they need assistance, and then they're going to get it to them not understanding that these are organisms that sort of evolved on their own without our help. [...] And so, a more hands-off approach, less manipulative approach is often hard to get through to them, particularly the ones that don't have any training in natural resources management.” (Environmental Manager Perspective)

Alternative motivations give rise to alternative management philosophies. When these persist among project leaders and managers in an organization, they can undermine the organizations' programs. In this case, goal misalignment is most likely to occur where there is the highest engagement from stakeholders. Since volunteer stakeholders are more

likely to carry alternative motivations and goals, goal misalignment and target fixation resulting from it are more likely to occur where they are most involved.

[In reference to managers' actions] *"On a big scale, it's driven by the organizations. But then you can just get an individual manager that just feels a certain way and has some experience that tells them, "Well, I need to do this." And a lot of times, it's contrary to the overall goals or missions of the larger organization."* (Environmental Manager Perspective)

The scale of these issues in the Sea Turtle Coop is quite small. These problems exist, but not to the extent where they are perceived as being significantly deleterious to the program. All the data demonstrate that the program has been wildly successful. Target fixation has the potential to create significant issues for collaborative environmental managers, but in this case it does not impede the success of the program. Stakeholder engagement can succeed even when beset with some target fixation, but it is important to recognize it so that it can be managed appropriately.

4.7. Discussion

Stakeholder engagement can be a useful tool for environmental managers. Engaging stakeholders in the management process creates substantial benefits at the functional level by increasing the manpower and resources available to the agency, increasing the organizations' management capacity. At GDNR, the participation of local stakeholders is essential to sea turtle conservation in Georgia, increasing the ability of GDNR to successfully manage turtles. This finding reinforces the expanding literature on the benefits stakeholder engagement provides (Beierle, 2002; Fischer, 2000; Reed et al., 2008).

This study also demonstrates the role of different actors' motivations in the management process. The motivations that lead stakeholders to engage are often different than those of the organization they work with. These alternative motivations are important for bringing people to the table and providing diverse perspectives to collaborative groups. However, in situations where engagement is intended to take place at the functional level rather than in decision-making, introducing individuals with divergent motivations into a management program can create goal misalignment within the organization. Stakeholders with alternative motivations often want to accomplish different goals than those sought by the organization they are engaging with, creating the potential for issues to arise. Misaligned goals can cause tension and counterproductive decisions to be made (Fleming et al., 2015). Furthermore, the alternative motivations this misalignment stems from are exceptionally hard to remove and remain deeply engrained in individual stakeholders. Even if they directly contradict the formalized goals that are enforced by the organization, these motivations are persistent and remain the primary driver for many engaged stakeholders. While this can be beneficial in contexts where it is appropriate to collaboratively engage stakeholders in decision-making, it intensifies goal misalignment in situations where stakeholder interaction is only deemed appropriate at the functional or consultative level.

When goal misalignment occurs, target fixation can arise. Managers pursuing different goals than the organization may operate outside of organizational bounds, misinterpreting management directives or implementing unsanctioned management actions on their own. Target fixation has the potential to undermine management outcomes and harm ecological outcomes. If managers spend a disproportionate amount of

time and resources pursuing individual goals rather than those of the management program, or implement actions that are potentially deleterious for other management subjects, overall performance may suffer. Integrating these considerations into environmental policy decisions can help create more appropriate and effective management processes in the future.

Different levels of engagement are appropriate for different situations and management contexts (Reed, 2008; Richards et al., 2004). It is important to understand both the benefits and drawbacks of different kinds of participation before introducing them to management in the field. Stakeholder engagement is a powerful tool, particularly for charismatic subjects that attract widespread public enthusiasm and conservation priority like sea turtle species (Brambilla et al., 2013; Colléony et al., 2016), but it can bring challenges as well. Engagement creates room for goal misalignment and target fixation within management organizations, potentially undermining management decisions.

These findings reveal a tipping point in the benefits of stakeholder engagement for management organizations seeking participation at the functional level. Independent stakeholder motivations are essential for bringing volunteers to the table, as high levels of enthusiasm for a subject can motivate large numbers of stakeholders to engage increasing organizations' management capacity. However, this involvement introduces individuals with alternative motivations to the picture, creating goal misalignment in the organization. As these stakeholders are relied upon more, and their influence increases, target fixation can influence the decisions being made, compromising management outcomes.

We need to be cognizant of the full implications of stakeholder engagement before utilizing it. While collaborative participation is useful in many contexts, other management situations require technical expertise and experience to make appropriate decisions, and are organized to utilize participation at the consultative and functional levels, not in decision-making. Stakeholder engagement is a powerful tool in these situations and is essential to many organizations' ability to implement environmental management programs. However, if the goal misalignment it introduces exerts too much influence and subjects management decisions to target fixation, too much reliance on engagement has the potential to undermine management.

While the benefits of collaboration are well studied, these potential drawbacks have not previously been well-documented. This research introduces and describes the destructive potential of target fixation. While collaborative management is a great tool and can yield substantial benefits, it can come with drawbacks. Target fixation has the potential to significantly undermine collaborative management programs. While this creates the potential for seriously deleterious effects, it does not necessarily cause them. The Sea Turtle Coop is highly successful despite dealing with some target fixation. As long as it is controlled or mediated, the impact of target fixation can be controlled. However, this requires policymakers and practitioners to think about when engaging stakeholders is appropriate for environmental management and to what extent it should be employed. Integrating these considerations in environmental policy decisions can help create more appropriate and effective environmental management. Future research should investigate the extent, frequency, and intensity of target fixation in implementations of engagement to investigate the generalized effects it has on environmental management.

4.8. Conclusions

Implementing appropriate and effective environmental management initiatives is becoming increasingly important. Understanding the implications of different management strategies is critical. While stakeholder engagement has many benefits, its implications for environmental management are poorly defined and deserve further investigation. It is critical that we understand the full implications of engaging stakeholders before implementing this tool.

In this analysis, I analyze stakeholder engagement at the Georgia Sea Turtle Cooperative, an environmental management program run by GDNR in a qualitative case study. Triangulating data from semi-structured interviews and questionnaire responses from a variety of different stakeholders and managers involved in the program, I investigate how engagement impacts GDNR's ability to manage sea turtles, the motivations of its agents, and how their motivations influence the management actions implemented.

Stakeholder engagement creates substantial benefits for GDNR in its sea turtle management program at the functional level increasing its management capacity. Many of GDNR's initiatives could not be implemented without the help of volunteers. However, this engagement also opens the organization up to alternative motivations among its participants creating goal misalignment in the agency. This misalignment can lead to target fixation, undermining management plans and creating issues for ecological subjects. While participation is designed to challenge goals in many groups pursuing collaborative decision-making, engagement is only appropriate at the functional level in

some contexts. In these situations, it is important to consider the potential tipping point of stakeholder engagement. The Sea Turtle Coop is itself an example of a program which suffers from some target fixation yet is still perceived as highly successful. However, target fixation has the potential to be significantly deleterious in many settings. Policymakers and practitioners need to acknowledge this issue and incorporate it into decisions about when and how to incorporate collaboration into environmental management initiatives.

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CHAPTER 5

AS THE CROW FLIES: MOVING BEYOND A PROXIMITY-BASED UNDERSTANDING OF POLICY DIFFUSION

Evan M. Mistur

5.1. Introduction

Research surrounding the spread of ideas, programs, and policy initiatives has given rise to a growing literature on policy diffusion. This research is concerned with explaining why policies are transmitted between governments or other decision-making organizations and understanding the mechanisms that make such transmissions possible (e.g. Boushey, 2010). Recognizing the underlying processes driving policy spread and adoption is critical to understanding the policy landscape in the US and discerning how different governments affect one another's decisions. The body of literature on policy diffusion is well developed, detailing the theoretical underpinnings and empirical justification for a wide variety of determinants driving policy spread at a large scale (see Shipan & Volden, 2008; 2012). However, the micro-level mechanisms through which policy diffusion occurs are not well-specified or tested. Research is needed to understand the fine-grain processes through which policy ideas and implementation diffuse.

In the US, policy diffusion is frequently studied at the state level (e.g. Boehmke & Witmer, 2004; Lyon & Yin, 2010; Woods, 2006), with states acting as policy laboratories (Elazar, 1972) where novel policies are implemented experimentally before spreading to other states. Current diffusion models outline a number of internal (e.g. economics and politics) and external (e.g. competition, imitation, and learning) determinants guiding a

policy's likelihood of diffusing (Shipan & Volden, 2008). While both types of determinants are important factors in policy spread and adoption, the precise mechanisms driving external determinants are unclear. External drivers are often predicted to interact through regional proximity (e.g. Berry & Berry, 1990; Berry, 1994; Mooney, 2001), but recent studies have called this mechanism into question by empirically demonstrating that it fails to satisfactorily explain policy diffusion in many situations (Matisoff & Edwards, 2014; Zhou et al., 2019). More refined, time-variant mechanisms of diffusion are needed to understand how policy diffusion takes place at a micro level.

Since the first policy of its kind was established in Texas in 1993, state birdwatching trail programs have been created across the US. These small-scale, state-level ecotourism programs have spread dramatically, now being present in 34 US states, and offer a unique opportunity to study the micro-level mechanisms of policy diffusion. This policy context is ideal for examining diffusion at a high resolution because the programs in question are highly relevant to one nationwide special interest group, but otherwise remain small-scale, low-cost, and uncontroversial. Since they retain very little public interest outside of the birdwatching community, monitoring the movement of birdwatchers as members of a special interest group provides a way to understand the conduits through which policy knowledge flows much more closely. Furthermore, the low-cost, low-profile nature of these programs exempts them from many of the driving implementation factors, such as resource availability and political debate, that confound understanding of how many more expansive policy platforms spread. The uncontroversial nature of birdwatching trail programs provides a clear look at policy diffusion in its most basic form.

In this research, I examine the spread of birdwatching trail programs in the US in order to understand the underlying mechanisms by which policies diffuse. Using a unique set of policy and citizen-science data, I develop and test a more theoretically convincing alternative to regional proximity as a micro-level mechanism of policy diffusion.

5.2. Literature Review

5.2.1. Policy Diffusion

In the policy literature, diffusion refers to the transmission of policy ideas across institutional or governmental boundaries. Policy diffusion occurs when policy decisions made within one governance unit are imitated by others (Shipan & Volden, 2012). Governments often piggyback on one another by emulating each other's policies (Brinks & Coppedge, 2005; Simmons & Elkins, 2004). US states, in particular, are often viewed as policy laboratories which act as testing grounds for novel policies; if the policies are successful in one state, others may adopt them as well (Elazar, 1972; Volden, 2006). The likelihood of diffusion is driven by a mix of internal and external determinants. It can occur due to a variety of different theoretical motivations, depending on the situation (Shipan & Volden, 2008).

5.2.2 Internal Determinants

Internal characteristics, such as local politics and economics, are commonly found to influence the likelihood of policy diffusion (Conan & Baum, 1981; Glick, 1981; Gray, 1973; Regans, 1980; Lee & Koski, 2015; Huang et al., 2007). Policymakers are more

likely to observe and emulate policies from states which are considered similar to their own, especially if the desirability or potential for policy success is driven by situational factors (Grosbeck et al., 2004). Internal problem severity also helps decide policymakers' motivation to address an issue, while existing regulations can either facilitate or hinder implementation of relevant innovations (Mohr, 1969; Walker, 1969). Context is critical in defining the set of policy options that different states have the opportunity to emulate.

Ideology and politics have been consistently demonstrated to be important factors driving imitation and diffusion between states (Bromley-Trujillo et al., 2016; Huang et al., 2007; Matisoff, 2008; Matisoff & Edwards, 2014; Shipan & Volden, 2012). Similarly, state economics are crucial, with funding having a commanding force over the policy options that are available to different states. Imitating their peers' successful policies is only possible if states can afford to implement those policies themselves.

5.2.3 External Determinants

Alternatively, external determinants which create inter-governmental interaction can drive policy diffusion. Competition over economic resources or other state-level benefits can spur states to adopt their successful rivals' policies (Baybeck et al., 2011; Berry & Baybeck, 2005; Cao & Prakash, 2012; Tiebout, 1956; Woods, 2006). Governments may institute policies that give them a political or economic edge, allowing them to attract more, or more desirable, citizens and firms. States may compete to supply the most advantageous benefits to their citizens through public works, regulations, or the creation of public or private goods (Berry & Berry, 1990; Shipan & Volden, 2012). If

demand for a specific type of good or environmental resource arises, states may compete to provide it or to disseminate information about its availability. Such competition can lead to the adoption of new or expanded state policies (Boehmke & Witmer, 2004).

Governments can also be coerced into imitating novel policies by external regulative forces or through social and political pressure (Shipan & Volden, 2012). Alternatively, they may learn from their peers, benefitting from experimentation of other states by implementing policies that have proven successful elsewhere (Simmons et al, 2006; Levy, 1994; Meseguer, 2006). Pathways of knowledge transfer facilitate imitation among peer states that have similar culture or ideology (Brooks & Kurtz, 2012), political identity (Matisoff & Edwards, 2014), or regional position (Biese Bender & Tosun, 2014). Interconnectivity between similar governance units allows imitation to act as a major cause of policy diffusion (Case et al., 1993; Dobbin et al., 2007).

5.2.4. Mechanisms of Diffusion

These determinants have been theorized to drive policy diffusion through a number of different mechanisms. Interaction between individual policymakers, advocates, and citizens of different states are through to provide opportunities for policy knowledge to spread, facilitating diffusion. However, robust data at this scale is difficult to obtain, limiting the number of studies that examine such measures at a high resolution. Instead, regional proximity diffusion models are commonly used to proxy for interstate interaction and the potential for knowledge transfer, creation of trans-boundary policy networks, and other relevant drivers of policy spread (e.g. Berry, 1994; Conan & Baum, 1981; Mintrom, 1997; Mooney, 2001). Since travelling farther distances usually entails

higher costs of movement, regional proximity is thought to increase the level of communication between governance units. According to this logic, the closer two states are to one another geographically, the more likely they are to share knowledge and spread policies to one another. Many studies rely on this logic, using neighboring states as a proxy for actual interaction (Boehmke & Witmer, 2004; Daley, 2007; Daley & Garand, 2005; Dincer et al., 2014). Geographical closeness is an important factor and has been demonstrated to help influence likelihood of policy diffusion (Berry & Berry, 1990; Chandler, 2009).

However, there are serious limitations to this metric as a proxy for micro-level determinants of policy diffusion. While regional proximity does have a role in deciding the likelihood of policies to spread between states, the situation is much more complex in reality. In the past, geographical distance would greatly constrain the ability of individuals to travel and interact with one another, but with decreasing costs of travel and communication it is unclear that such restrictions still have a prominent role in how policy ideas spread. States may look at the examples set by their neighbors, but nothing restricts them from also considering policy ideas from elsewhere in the US, or across the world. In today's environment, where long-distance travel and networking are commonplace, geographic constraints are not a theoretically convincing measure of the potential for diffusion.

The empirical research testing regional proximity models has yielded mixed results. A growing number of studies fail to find evidence of regional diffusion after controlling for internal determinants (Matisoff, 2008; Matisoff & Edwards, 2014; Lyon & Yin, 2010; Stedelman & Castro, 2014; Zhou et al., 2019; Yin & Powers, 2010). The

overbearing focus on regional proximity in the literature has largely excluded other potential channels of diffusion from the conversation; these alternatives need to be studied more closely (Nicholson & Carley, 2018). Additional research is needed to explore policy characteristics and the diffusion mechanisms that drive their spread (Jordan & Huitema, 2014). While regional proximity can, to some extent, proxy likelihood of diffusion at a macro level, we need more refined micro-level mechanisms that account for individual-level movement and variance over time to understand how policies spread.

Research on innovation diffusion more frequently examines the micro-level mechanisms related to knowledge transfer by analyzing social learning (Geroski, 2000; Kapur, 1995; Vetas, 1998) and network-based information sharing (Reagans & McEvily, 2003). Social networks and communication are important factors in how knowledge spreads (Becker, 1970; Burns & Wholey, 1993; Coleman et al., 1966; Palmer et al., 1993). Geroski (2000) promotes an epidemic explanation of technology diffusion where innovations are assumed to originate at a central source and spread to other adopters over time. Barriers to knowledge transfer are the primary constraint to an innovation's spread. If potential adopters do not know about an innovation then they will not implement it, but as they communicate with others and learn about the new idea the innovation will spread. Information sharing among individuals and groups facilitates diffusion (Reagans & McEvily, 2003).

Social connections can be highly conducive to the spread of innovations as knowledge flows along network paths, encouraging diffusion through learning (Levitt & March, 1988; Mansfield, 1971; Rogers, 1983; Huber, 1991; Haunschild, 1993; Kapur,

1995; Vetas, 1998; Galaskiewicz & Wasserman, 1989). The size, strength, and diversity of social networks impacts their propensity to facilitate knowledge sharing. Diffusion occurs more readily along short network paths (Jackson, 2010) and in networks with strong social cohesion and members from diverse knowledge groups (Reagans & McEvily, 2003). In policy arenas, diffusion can be further spurred by the presence of entrepreneurs (Mintrom, 1997). Transfer of new knowledge into a special interest group or community network can activate new policy entrepreneurs from that community, generating more opportunities for policies to be implemented.

These conceptualizations do not artificially bound the potential for interaction and diffusion with geographical constraints. Widespread, even global, diffusion can occur (Brooks, 2005; Weyland, 2009). Borracci and Giorgi (2018) find that special interest groups can be an important driver, demonstrating that imitation among local members of a specialist community can cause innovation diffusion. Conley & Udrey (2010) further refine our understanding of how individuals interact by demonstrating that technological innovations can spread between “information neighbors”. Their conception of “information neighborhoods” models interaction, and diffusion of ideas, between individuals through their communication networks rather than simply through regional proximity. While individuals’ proximity to one another is a factor in driving the connections they form, geographical closeness is neither necessary nor sufficient for communication to occur between parties.

These micro-level mechanisms do a better job of explaining how knowledge and innovations spread, but further work is needed to understand the phenomenon of diffusion more deeply in a policy context. The role of networks in diffusion remains

unresolved and should be examined further (Westphall et al., 1997). This is particularly true for policy diffusion where applications of convincing micro-level mechanisms remain scarce. Lessons from the innovation diffusion literature are valuable to our understanding of policy diffusion, but mechanisms that are tailored to a policy context are necessary in order to provide a robust understanding of what is taking place.

5.3. Policy Context

The spread of birdwatching trail programs through the US offers a prime opportunity to study high-resolution mechanisms of policy diffusion. These programs take a variety of shapes, but all follow the same general pattern, designed to map, organize, and promote the best birdwatching locations in a state for the public. They are low-cost (requiring relatively few resources to implement), low-profile (carrying limited interest outside of the birdwatching community), and low-impact (primarily benefitting only individuals interested in ecotourism). These characteristics make birdwatching trail programs an ideal case to study policy diffusion. Since they are so small and uncontroversial, birdwatching trail programs are not heavily impacted by many of the variables that drive implementation of larger policies. The ability of a state or organization to implement a new policy is influenced by numerous environmental and situational factors such as resource availability, public support or opposition, and political debate over policy goals (Sabatier & Mazmanian, 1995). These factors can overwhelm the impact of diffusion and confound attempts to measure how policies spread. However, the general insalience and minimal costs associated with this policy case removes the overbearing influence of these factors, controlling for much of the noise that typically

surrounds implementation. Avoiding the confounding influence of large-scale drivers of implementation provides an opportunity to more closely isolate and examine the underlying impact of policy diffusion.

Second, the general restriction of public interest in these programs to the birdwatching community provides an opportunity to analyze the movement of policy-relevant individuals much more closely. Ordinarily, data restrictions prevent the micro-level movement of individuals over time to be studied. For large-scale policies, the number of relevant individuals who are potential information diffusers is too large, and the barriers to data collection too high, to effectively examine micro-level diffusion. However, since in general only birdwatchers take an invested interest in these niche programs, the scope of this analysis can be focused on a single special interest group. Birdwatchers offer the additional benefit of commonly participating in citizen-science, providing a source of information on where they travel over time. This unique coupling of policy scope and data availability yields an ideal opportunity to study how micro-level movements in a specialist community can drive the diffusion of relevant policies over time.

5.3.1. Ecotourism

Birdwatching trail programs are designed to promote local birdwatching and, as such, represent a type of ecotourism policy. Ecotourism is a popular form of consumer-based recreation. First coined by Hetzer (1965), the term represents a broad category of recreations targeting the environment, such as hiking, wildlife viewing, or hunting. The popularity of ecotourism has made room for a large, and growing, industry centered

around nature-based activities (McCamy, 1992; Weaver, 2001). The International Ecotourism Society (TIES) estimates that ecotourism generated about \$416 billion worldwide in 1994 (TIES, 2000). According to the US Department of Agriculture (USDA) National Survey on Recreation and the Environment (2000), 202 million people participated in ecotourism between 1999 and 2000 in the US alone. Since then, the number of Americans engaged in outdoor recreation has greatly increased and is projected to continue doing so in the future (White, 2016).

Birdwatching is a popular form of ecotourism where participants seek out birds in their natural habitat, identifying them in the wild using visual, auditory, and behavioral field marks. Birdwatching represents a sizable portion of overall ecotourism and is continuing to grow in popularity. In 2000, an estimated 70.4 million Americans, one third of the population, participated in some form of birdwatching based on self-reported statistics (Cordell & Herbert, 2002). This was a dramatic increase from the estimated 12% that participated in 1982 (Cordell et al., 1999). Between 1999 and 2009, the number of total birdwatchers rose again by an estimated 22.8%, among the largest increases of all the nature-based outdoor activities defined by the USDA (White, 2016). The majority of these participants only engage in the activity casually, based on their ability to identify birds. According to one study, only 3.2% of individuals who participated in watching birds could identify over 40 different species, and only 0.5% of them could identify over 100 (Kellert, 1985). Individuals who watch birds casually may not be as likely to be active in the birdwatching community or engage in ecotourism regularly. Nonetheless, the birdwatching community represents a sizeable population and creates demand for new areas of ecotourism development.

In the US, as in many countries where birdwatching is popular, birdwatchers make up a distinct special-interest group. Participants commonly self-organize into tight-knit communities centered around their pastime. Regional and national birdwatching associations, such as the National Audubon Society and American Birding Association (ABA), have widespread membership, and local birdwatching clubs and societies are commonplace. These groups organize birdwatchers and ecotourists together, networking them with others who share the same interests. Since birdwatchers are typically well educated and have above-average incomes (Ceballos-Lascurain, 1996; Cordell & Herbert, 2002), these groups can carry substantial social capital and have the potential to be highly influential policy actors. Influence from birdwatching groups in different states may help direct decisions about whether or not to implement birdwatching trail programs.

While these programs do not receive much attention outside of the birdwatching community, policymakers are incentivized to implement them if they have been informed about them as a legitimate policy option. Many birdwatching trail programs are designed and organized by volunteer members of the birdwatching community and create minimal costs for the agency that implements them. At the same time, they provide numerous potential benefits which can easily outweigh the insignificant costs associated with printing and signage that are necessary to set up the program.

Ecotourism can provide tangible economic benefits to local communities by raising employment opportunities and land values associated with natural attractions (Almeyda et al., 2010; Campbell-Hunt, 2014). Many consumers are willing to pay premiums for the chance to experience natural environments. When the situation allows, ecotourism can outcompete other local sources of income (Wunder, 2000), and outweigh

the value of conventional land uses, such as deforestation or agriculture (Gossling, 1999). Birdwatching can offer substantial benefits to local economies as avian enthusiasts visit the area looking for local birds (Biggs et al., 2011; Hvenegaard et al., 1989; Sekercioglu, 2002). This type of activity offers the potential for sustainable economic benefits for locals (Gunter et al., 2017; Meleddu & Pulina, 2016) particularly in rural areas underdeveloped areas where environmental resources are prevalent. Birdwatching trails have the potential to create economic benefits by attracting ecotourists. Furthermore, since tourist experience and satisfaction are significant factors in destination loyalty (Kim & Park, 2017), implementing these programs may provide a way to maintain an ongoing ecotourism industry.

States may also implement birdwatching trail programs, or expand the programs they have, in an effort to sustainably utilize their natural resources due to scientific or conservationist motivations. Ecotourism has been demonstrated as an effective way of maintaining and improving conservation of biodiversity and habitats (Bookbinder et al., 1998; Stewart et al., 2017). Sustainable wildlife viewing practices can alter wildlife habitats and be detrimental to native species (Alwis et al., 2016; Pichegru et al., 2016), but if done appropriately, ecotourism can sustainably benefit conservation. Consumers' willingness to pay for ecotourism is correlated with the health of local wildlife, so appropriate management can be cost-effective (Bach & Burton, 2016). Engaging in ecotourism has also been shown to increase environmental awareness and behavior among participants (Powell & Ham, 2008) providing more motivations for environmentally minded policymakers to increase ecotourism opportunities in their state. The agencies that implement birdwatching trail programs, frequently state departments of

natural resources, parks and recreation, or their equivalent, are often heavily populated with environmental scientists. These individuals are likely to support environmental goals since they are more likely to be educated (Meyer, 2016) and are engaged in environmental fields themselves. If they are scientists, they may also be more likely to value the data-collection opportunities increased birdwatching provides through citizen-science (Devictor et al., 2010; Sullivan et al., 2009).

Since birdwatching trail programs are very low-cost and have little potential for political controversy, states have very few reasons to demonstrably oppose their implementation. One of the largest factors constraining the spread and adoption of birdwatching trail programs is the availability of knowledge about the program. Since the program maintains such a low-profile, policymakers may simply not be informed that it exists. If policymakers do not know about the policy, they cannot implement it. This implies that policy-relevant knowledge diffusion is a critical factor driving how the policy spreads.

Birdwatchers themselves are a powerful medium of transmission for knowledge about this policy. Since birdwatching trail programs are designed to increase interest and resources for local avitourism, the birdwatching community, as a special interest group, has a clear motivation to promote them to policymakers. As birdwatchers travel between states, visiting and learning about trails in other states before returning home and sharing that information with local birdwatchers and policymakers, they transmit information about the program, facilitating policy learning. Special interest group movement over time can be used as a micro-level mechanism of policy diffusion.

5.3.2. Birdwatching Trails

The birdwatching trail programs implemented in US states all follow the same model. Each is tailored to the geographic and ecological context of its state, but similarly maps out networks of roads and trails connecting birdwatching sites, marks them with signage, and publishes a guide for public use.

Birdwatching trail programs are most often implemented at the state level by state departments, such as a department of natural resources or its equivalent, but some are developed by private NGOs or local groups keen on seeing the policy implemented in their state. While these differences are important to their development all the programs in this study have received state funding, partnership, or support and are generally homogenous in terms of their diffusion. Multiple trails can be created and operated side by side within a single state; many states which receive continued interest in the programs have expanded their programs, adding additional trails onto their original project over time.

Birdwatching trail programs connect and promote local environmental hotspots where the public can go birdwatching. The number and location of sites included in each version of the program is determined by its program leaders with input from local birdwatchers. Decisions are typically based on the quality of birdwatching available at the site (in terms of the variety and abundance of species that can be found there), the feasibility of adding the site to the expanding network, and the availability of existing infrastructure. The “birdwatching trail” itself is not a physical hiking trail between sites, but a mapped route connecting sites together via public roads and pathways, informing people how to access them. The sites themselves often include their own hiking paths and

trails in the surrounding natural environment, but birdwatching trail programs do not typically create new infrastructure. They are more accurately viewed as informational or ecotourism-promotion programs that increase awareness of, and ease of access to, existing birdwatching opportunities.

Each program maps out the state's best birdwatching locations, signs them, and publishes a map for the public showing how they can be reached. This map, or set of maps, is often published as a paper-bound brochure and made available for distribution at state facilities. Some states offer digital versions online and as smartphone apps as well. As such, these programs remain relatively small-scale operations that can be implemented at minimal cost.

The first birdwatching trail program, The Great Texas Coastal Birding Trail, was founded in 1993. It was designed as a sustainable development project aimed to attract birdwatchers to Texas and connect them with local stakeholders, such as private landowners and local businesses, to facilitate development of the avitourism industry (Lindsay, 2012). The program is sponsored and managed by the Texas Parks and Wildlife Department (TPWD) and was initially funded through the Transportation Efficiency Act (1991). The TPWD later expanded the program by creating connected trails throughout the rest of the state and now boasts nine trails in total. Since its creation, this program has been perceived as highly effective, and has served as an example for other states interested in emulating the policy concept.

Consequently, similar programs have sprung up around the US since 1993. As of 2019, 110 trails have been founded across 34 continental US states, with one additional state currently in development of another. The distribution of states with birdwatching

trail programs is depicted in Figure 7. This figure depicts the geographic spread of these programs over time, and clearly shows that the story underlying their diffusion is more complex than a simple mechanism of regional proximity would imply.

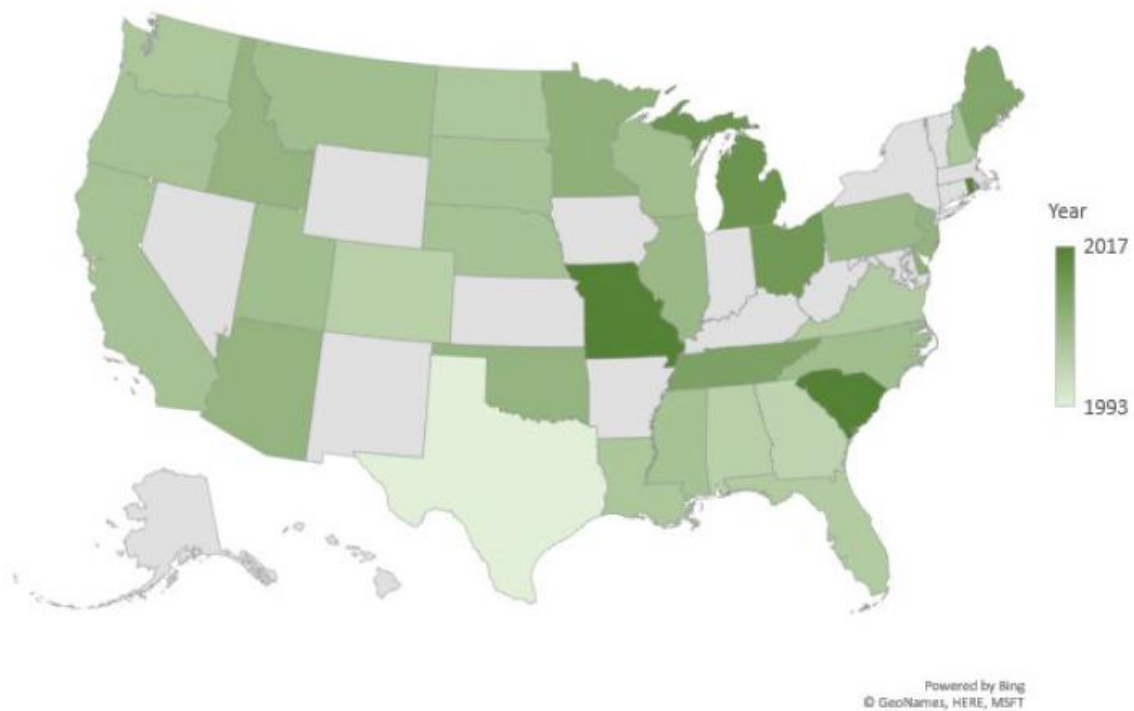


Figure 7: Date of State Implementation

As the literature suggests, policy diffusion may be a product of knowledge diffusion. Since interest in birdwatching trail programs is dominated by members of the birdwatching community, knowledge diffusion through that special interest group may be a critical driver of how states learn about the program. Birdwatchers who have heard

about, or acquired firsthand experience of, programs in other states may bring knowledge about the policy concept back to their home state. Local policy entrepreneurs can arise out of a state's birdwatching community once that community has learned about the policy concept. Special interest group movement between states is an important pathway through which policy knowledge can spread. Regional proximity is a very poor proxy for this kind of movement. While proximity does influence where individuals travel, it is not nearly as restrictive to where people go as that proxy would suggest. Birdwatchers, in particular, may be more likely to travel farther since they are often incentivized to leave their local area in search of bird species when travelling for their hobby. Since the bird species present in nearby states are often very similar, individuals who travel to watch birds will often choose to travel farther abroad in search of species that are not present where they live.

The more exposure birdwatchers from a state have to states that already have birdwatching trail programs, the more likely it is for the idea to spread or expand within their home state. Policy diffusion may be driven by the movement of members of a state's special interest group as they travel, learn about novel policy ideas in other states, and then return home. Tracking where birdwatchers travel from year to year can allow us to identify "information neighborhoods" between states, and understand which states are learning from each other. Since these "neighborhoods" may shift over time, it is important to maintain a time-variant approach. Tracking the movement of birdwatchers between states over time offers a unique, empirically testable micro-level mechanism of policy diffusion.

5.4. Materials & Methods

In this study, I empirically test a novel, time-variant mechanism of policy diffusion using a unique dataset which leverages citizen-science data to track birdwatchers' movement over time. Examining how movement within a special interest group contributes to policy diffusion can help clarify the potential and relevance of micro-level, time-variant mechanisms, developing existing theory and understanding of policy diffusion. Furthermore, this study demonstrates the utility of citizen-science data in operationalizing micro-level diffusion analyses.

5.4.1. Data

The strongly balanced panel dataset in this analysis is constructed from a variety of data organized at the state-year level. I supplement original data on birdwatching trail programs with records of birdwatcher movement and socio-political, geographic, and environmental controls. The final dataset includes observations for the population of continental US states from 1993, when the first program was created, to 2016. Alaska and Hawaii are outliers in terms of geographical location, cost of travel, and biodiversity and are excluded from the study.

The dependent variable is a continuous variable indicating the number of birdwatching trails in a state. Information on each program comes from archival records and informal phone interviews with program personnel. While detailed records for many programs did not previously exist, the nature of these programs guarantees their observability. Birdwatching trail programs are intended to advertise local birdwatching

resources, so their presence is necessarily observable, mitigating the threat of observation bias.

A novel, time-variant mechanism models policy diffusion at a micro level by measuring special interest group movement over time. This mechanism is operationalized as the number of birdwatchers from a state who visit states with birdwatching trail programs in a year. This provides a measure of both the direction and frequency of visitations between states, providing a look at the amount of policy exposure members of each state's special interest group received each year. I also include four rival operationalizations of this mechanism as robustness checks: these are (1) the percentage of a state's birdwatchers who travel to states with programs in a year, (2) the total number of visits they make to states with programs each year, (3) the percentage of visits they make to states with programs each year, and (4) the number of states with programs that birders from a state visit each year. The results of these robustness checks are included in Appendix A.

Citizen-science data from eBird (2013) provides information on individual-level movement among the US birdwatching community. This platform is rapidly growing and used by a large number of birdwatchers; it should offer a representative sample of US birdwatchers. When birdwatchers submit observations to eBird (2013), they provide data on the birds they observed at a specific location and time, and, in doing so, they create records of where they were each time they went birdwatching. This provides a unique look into how members of their special interest group circulate. The state where an individual records the most observations each year is considered their home state. This is a useful proxy for residency since birdwatchers most often watch birds close to home.

Since visitation between states shifts over time, it is important that this mechanism is treated as temporally dynamic. This offers a rough understanding of how time-variant movement patterns facilitate knowledge-sharing between states.

Several socio-economic and environmental variables serve as controls in the model. Citizen and government politics and ideology are important drivers of policy diffusion (Carley & Miller, 2012). The model incorporates metrics developed by Berry et al. (1998) for each, measured along a 100-point conservative-liberal continuum. Tourism spending may also influence adoption of these ecotourism programs. As the amount of tourism imports and spending increase, states will have greater incentive to develop a birdwatching trail program to capture part of those benefits. Financial variables for US tourism imports and domestic spending from the National Travel & Tourism Office (NTTO, 2016), measured in 2013 dollars, control for these factors. State population helps control for growth over time, based on the most recent 10-year US census for each year (US Census Bureau, 1990; 2000; 2010). Avian biodiversity and density are also important resources for birdwatching trail programs and likely influence decisions about whether to adopt. Biodiversity is measured as the number of bird species recorded in a state each year, while density is measured as the average number of individual birds observed by birdwatchers each year as reported in eBird (2013) data. Finally, a set of annual dummies control for temporal trends in the data. Descriptive statistics are reported in Table 7.

It is important to note the potential limitations of these data. Birdwatchers may deliberately travel to states that already have birdwatching trail programs in place in order to take advantage of those ecotourism resources. This could introduce endogeneity

to the sample if the birdwatchers acting as a conduit for the spread of policy knowledge are being selectively exposed to states based on their policy status.

Table 7: Descriptive Statistics

Variable	Description	n	Mean	Std. Dev.	Min/Max
Dependent Variable	Number of birdwatching trails in a state	960	0.87	1.789	0 9
Diffusion Mechanism	Number of birdwatchers who visited other states with programs in a year	960	44.16	82.865	0 838
Citizen Ideology	“Liberalness” of state citizens	940	49.47	15.105	8.45 95.97
Government Ideology	“Liberalness” of state government	940	47.87	27.98	0 99.17
Spending	Annual domestic tourism spending (2013 \$, millions)	960	128304.3	18429.94	93409.43 168542.1
Imports	Annual tourism imports (2013 \$, millions)	960	105667.3	11095.05	84030.57 123130.5 0
Population	State Population	960	5972340	8457727	453588 1.12e08
Species	Number of bird species observed	960	328.46	67.753	127 617
Bird Density	Number of birds observed per birdwatcher	960	3895.51	7051.472	7.68 111761.6

Furthermore, policy adoption is not immediate since it takes time for state programs to be developed, advocated for, and implemented. Consequently, the impact of the independent variables in the model are likely delayed. Fortunately, the small scale and low profile of birdwatching trail programs mitigates the potential for endogeneity to bias the results.

While US birdwatching trail programs are marketed, they are largely limited to doing so within state borders. Most programs are small in scope and impact and have very limited

ability to attract potential users from other states. Additionally, all time-variant independent variables in the model are lagged by one year to account for the lead time required for policy adoption and help control for potential endogeneity.

5.4.2. Methods

Fixed effects regression is an effective method for controlling for unobserved heterogeneity between groups when using panel data (Allison, 2009). State characteristics may help drive the likelihood of implementing birdwatching trail programs, so it is important to control for state-level variables that differ between states but are consistent over time, such as cultural norms and environmental context. Using a panel effects regression model controls for this heterogeneity. Since these individual-specific effects are correlated with independent variables in the model, fixed effects are the most appropriate method and will produce the most accurate estimates (Woolridge, 2010). This methodology allows me to test the impact of special interest group movement on policy diffusion over time.

I also conduct a set of three robustness checks, testing the quality of the mechanism of diffusion in the model. I code three alternative conceptualizations of how to measure special interest group movement in the birdwatching community over time, and test each of these using fixed effects models in order to gauge the reliability of my measurement of special interest group movement. Detailed descriptions of each of these alternative mechanisms and their robustness checks are in Appendix B.

5.5. Results

Special interest group movement drives policy diffusion. The more exposure states have to birdwatching trail programs through the birdwatching community, the more likely they are to establish, or expand, their own program. Table 8 presents results from the model. A copy of the full results, including estimates for annual trends is in Appendix A.

The novel mechanism I introduce significantly drives program diffusion and development. States become more likely to develop a birdwatching trail for each local birdwatcher that travels to a state with a similar program. The more birdwatchers that travel to places with established programs, the more exposure to the policy idea they create at home, and the more likely their state is to implement or expand the program.

Table 8: Fixed Effects Regression Results

Variables	<i>Fixed Effects Model</i>	
R-squared (within)	0.3752	
Likelihood of Policy Adoption	<i>Coefficient</i>	<i>Standard Error</i>
Birdwatcher Movement	3.51e-03***	7.14e-04
Citizen Ideology	-8.21e-03	8.06e-03
Government Ideology	-6.19e-03***	2.09e-03
Population	-4.87e-09	6.84e-09
Spending	5.93e-05*	3.44e-05
Imports	-5.35e-05	4.38e-05
Species	5.61e-03**	2.41e-03
Bird Density	6.51e-06	6.36e-06
Annual Trends	-	-
Constant	-3.402***	0.91

*** p<0.01, ** p<0.05, *p<0

The robustness checks designed to verify the strength of the primary measurement of policy diffusion are included in Appendix B. With the exception of one alternative measurement, these tests reveal the same general results as the primary model. While, the primary coding of the mechanism remains the strongest way to measure birdwatcher movement conceptually, these alternatives help reinforce its legitimacy.

5.6. Discussion

This analysis provides strong evidence that policy diffusion can be driven by special interest group movement. Just as some birds facilitate the spread of plant species by carrying their seeds over long distances, birdwatchers spread the conceptual seeds of birdwatching trail programs throughout the US wherever they travel. The geographical constraints that are so often relied upon to explain policy diffusion are not a satisfactory mechanism for predicting how policies spread at the micro level. Time-variant measures of special interest group movement offer a reliable, and more theoretically convincing model. Regional proximity is only part of the equation guiding diffusion over time.

The diffusion of these programs provides an excellent opportunity to study these patterns at a high resolution and offers perspective on how policies can diffuse when the situation is relatively uncontaminated by the funding issues which cloud the adoption of most policies. However, recognizing context is critical to understanding micro-level relationships. My data do not allow me to observe policy entrepreneurs at the ground level or the likelihood of individuals who have encountered a novel policy to champion it in their home state. Furthermore, I only assess diffusion at the state level while several birdwatching trail programs are operated at local and interstate levels by private actors.

While assuming program homogeneity provides the opportunity for a broad analysis at the state level, the relationships in the model may vary for some sub-groups of programs. Additional data and analysis is needed to map the sponsorship of these trails and identify more nuanced program-level impacts that may arise. Future research should consider these factors when developing diffusion research.

This study helps build on current diffusion theory, contributing a deeper understanding of the micro-level mechanisms that drive it. Previous research has struggled to identify the precise means by which policy ideas diffuse. Data restrictions and simplified assumptions have led to an overreliance on regional proximity to explain the phenomenon and ignored the potential for more refined temporal and spatially variant mechanisms. Tracking the movement of special interest groups provides a more precise and nuanced way to measure policy exposure and knowledge diffusion over time. This study identifies this mechanism as an appropriate alternative to traditional conceptualizations and points out potential for measuring it. As citizen science datasets continue to expand their user bases and grow they will become an increasingly rich source of information, not only for the primary subjects they focus on, but for the characteristics and behavior of their users. Future policy research should leverage this unique source of data. These findings may also be useful to policy advocates or entrepreneurs. Policy advocates may find success organizing their strategies around influencing special interest groups in order to leverage their impact on state policymakers.

Finally, this analysis sheds some inferential light on the viability of ecotourism in developed areas. Ecotourism is typically studied in undeveloped areas of the world (e.g.

Almeyda et al., 2010; Smith & Scherr, 2003) and is not well understood within a first-world context (Weaver & Lawton, 2007). There is some evidence that ecotourism can work in rural areas of developed nations (Che, 2006), but its potential for creating sustainable markets for conservation in such countries is uncertain. This study does not test the success or performance of birdwatching trail programs and is not intended to do so. However, by showing how these programs have propagated over time, it provides some inferential evidence that ecotourism programs can be successful in developed areas. Not only have these programs survived across the US, but they have been perceived as successful enough to spread. Future research should explore this subject further.

5.7. Conclusions

Policy diffusion is a well-developed area of study. However, the micro-level mechanisms that drive policy spread are not well understood. Research on this subject relies heavily on regional proximity to predict diffusion even though it has been pointed out as an unsatisfactory metric. In this research, I develop and test a time-variant mechanism of micro-level diffusion to investigate the spread of birdwatching trail programs across the US.

The diffusion of these programs is significantly driven by special interest group movement. As individuals travel around the country, they expose themselves, and their home states, to new policy ideas, making diffusion more likely to occur. This micro-level mechanism does a more theoretically convincing job of explaining policy diffusion than regional proximity. Future research should consider this mechanism and continue to build on diffusion theory when studying policy spread at a micro level.

CONCLUSION

Environmental issues are persistent and are a cause of rising concern in many areas around the world. Despite increasing public attention (Dunlap & Mertig, 2014) and activism for change, these issues are not going away any time soon. Therefore, the systems we use to administer environmental management services are key to responding, adapting to, and dealing with the ecological systems around us. Public administration represents a key link between social and environmental components of Social-Ecological Systems (SES) and is integral to how these systems operate. Implementing appropriate policy and management processes can allow us to effectively interact with the environment, ensuring sustainable provision of the ecoservices society relies on and mitigating the downsides of system change. However, doing so requires more understanding of how different administrative structures function and interact with both each other and the natural environment.

Environmental systems are not the only subjects that change over time. The administrative landscape is dynamic as well and hosts a long-standing theoretical discussion about the merits of bureaucratic and collaborative structures of organization and decision-making (e.g. Agronoff & McGuire, 2003; Alter & Hage, 1993; Irvin & Stansbury, 2004; Rothschild & Russell, 1986; Simon, 1965; Weber, 1978). Debate over which strategies are most effective for administering public services is prevalent for many contexts, including for environmental management. Furthermore, as US environmental agencies are continuing to face downsizing (EIP, 2019), managers are being forced to adapt to new ways of administering their work. The hollowing out of the

state is forcing many managers to adopt alternative tools and strategies (Milward & Provan, 2003). It is critical that we understand how these systems, and the decision-making processes they use, operate and interact within the context of the SES framework.

This dissertation begins an exploration of this subject-matter, examining areas where bureaucratic and collaborative structures overlap to better understand how they operate and impact the SESs they are designed to interact with. In it, I investigate how these seemingly dichotomous structures can function together, the implications of integrating them with one another in practice, and what causes them to diffuse. The results can be useful for both researchers interested in investigating the impact of decision-making structures on environmental management and practitioners tasked with deciding how to appropriately approach management subjects. This should help set up future research to look at how best to structure environmental management programs, how those structures interact with social actors, and how they directly impact ecosystem health.

APPENDICES

Appendix A

Table 9: Fixed Effects Regression Results (Extended)

Variables	<i>Fixed Effects Model</i>	
R-squared (within)	0.3752	
Likelihood of Policy Adoption	<i>Coefficient</i>	<i>Standard Error</i>
Birdwatcher Movement	3.51e-03***	7.14e-04
Citizen Ideology	-8.21e-03	8.06e-03
Government Ideology	-6.19e-03***	2.09e-03
Population	-4.87e-09	6.84e-09
Spending	5.93e-05*	3.44e-05
Imports	-5.35e-05	4.38e-05
Species	5.61e-03**	2.41e-03
Bird Density	6.51e-06	6.36e-06
1995	0.22	0.379
1996	-0.20	0.250
1997	-0.52***	0.202
1998	-0.27	0.306
1999	0.55	0.801
2000	0.24	0.569
2001	0.17	0.694
2002	1.43	1.097
2003	2.06*	1.213
2004	2.69*	1.468
2005	2.68*	1.622
2006	2.68*	1.520
2007	2.82*	1.582
2008	2.18*	1.186
2009	1.64**	0.823
2010	1.72**	0.723
2011	0.76***	0.291
2012	-	-
2013	-	-
Constant	-3.402***	0.91

*** p<0.01, ** p<0.05, *p<0.01

Appendix B

Table 10: Descriptive Statistics of Alternative Mechanisms

Variable	Description	n	Mean	Std. Dev.	Min/Max
Mechanism 2 (M2)	The total number of visits taken by birdwatchers from a state to states with a program each year	960	472.71	1262.156	0 13585
Mechanism 3 (M3)	The percentage of birdwatchers from a state that travelled to a state with a program each year	960	49.30	33.898	0 100
Mechanism 4 (M4)	The percentage of total visits taken by birdwatchers from a state to states with a program each year	960	5.24	5.26	0 41.67

Table 11: Alternative Mechanisms Robustness Checks

Variables	Model 1		Model 2		Model 3	
Adoption	<i>Coef.</i>	<i>Std. Err.</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>Coef.</i>	<i>Std. Err.</i>
M2	7.65e-05*	4.21e-05	-	-	-	-
M3	-	-	9.70e-03***	3.13e-03	-	-
M4	-	-	-	-	-0.16	0.011
Cit.	-8.7e-03	8.2e-03	-8.5e-03	8.1e-03	-9.6e-03	8.2e-03
Ideology						
Gov.	-6.1e-03***	2.1e-03	-6.2e-03***	2.1e-03	-5.5e-03***	2.1e-03
Population	-1.48e-09	6.88e-09	-4.22e-10	6.85e-09	-9.23e-10	6.88e-09
Spending	6.5e-05*	3.49e-05	3.5e-05	3.6e-05	6.61e-05*	3.5e-05
Imports	-5.0e-05	4.5e-05	-2.4e-05	4.4e-05	-4.2e-05	4.4e-05
Species	5.4e-03**	2.4e-03	5.2e-03**	2.4e-03	5.2e-03**	2.4e-03
Bird	6.24e-06	6.44e-06	6.01e-06	6.42e-06	5.83e-06	6.45e-06
Density						
1995	0.21	0.384	0.09	0.382	0.16	0.383
1996	-0.26	0.253	-0.22	0.253	-0.33	0.253
1997	-0.63***	0.204	-0.45**	0.216	-0.75***	0.204
1998	-0.42	0.312	-0.31	0.312	-0.60*	0.306
1999	0.41	0.816	0.11	0.805	0.18	0.808
2000	0.11	0.580	-0.06	0.57	-0.09	0.573
2001	-0.01	0.710	-0.28	0.695	-0.26	0.698
2002	1.46	1.115	0.53	1.130	1.37	1.11
2003	2.18*	1.231	1.00	1.267	2.18*	1.23
2004	2.88*	1.489	1.37	1.540	2.87*	1.491
2005	2.76*	1.649	1.23	1.682	2.62	1.645
2006	2.73*	1.547	1.29	1.574	2.57*	1.542
2007	2.91*	1.610	1.38	1.641	2.74*	1.605
2008	2.20*	1.209	1.05	1.227	2.02*	1.202
2009	1.59*	0.842	0.80	0.845	1.40*	0.832
2010	1.87**	0.733	0.99	0.772	1.93***	0.738
2011	0.80***	0.296	0.41	0.312	0.80***	0.297
Constant	-4.29***	0.910	-2.98***	1.040	-5.07***	0.908

*** p<0.01, ** p<0.05, *p<0.1

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